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Strait of Georgia Sport Fishery Creel Survey

Statistics for Salmon and Groundfish, 1990

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STRAIT OF GEORGIA SPORT FISHERY CREEL SURVEY

STATISTICS FOR SALMON AND GROUNDFISH, 1990

by

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ABSTRACT

Collicutt, L. D. and T. F. Shardlow. 1992. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1990. Can. Manuscr. Rep. Fish. Aquat. Sci. 2109:76.

Catch and effort statistics for the Strait of Georgia tidal sport fishery are presented for each month in 1990. The statistics were derived by combining the data from over 32,500 interviews and 68 aerial surveys. Estimates were provided for the number of sport fishing boat trips and the catches of chinook, coho, pink, sockeye and chum salmon along with rockfish, lingcod, dogfish and other finfish. Also given are numbers of marked (adipose fin-clipped) and unmarked chinook and coho examined during the creel survey, the age composition of chinook and the length frequency distribution of chinook, coho and lingcod catches. The appendix includes all catch and effort statistics for each combination of month and Statistical Area.

Key words: salmon, groundfish, creel survey, sport fishing, catch, effort, age composition, length distribution.

RÉSUMÉ

Collicutt, L. D. et T. F. Shardlow. 1992. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1990. Can. Manuscr. Rep. Fish. Aquat. Sci. 2109:76p.

Les statistiques sur les prises et l'effort de pêche dans le cas de la pêche sportive dans les eaux à marée du détroit de Géorgie sont présentées pour chaque mois de 1990. Les statistiques ont été établies en réunissant les données de plus de 32,500 entrevues et de 68 levés aériens. Des estimations ont été fournies pour le nombre de sorties des bateaux de pêche sportive ainsi que le nombre de prises de saumon quinnat, de saumon coho, de saumon rouge et de saumon kéta avec des sébastes, des morues-lingues, des aiguillats et autres poissons. On indique également le nombre de saumons quinnat et coho marqués (nageoire adipeuse coupée) et non marqués examinés dans le cadre de l'enquête sur la pêche sportive, ainsi que la composition par âge et la répartition par longueur des prises de saumon quinnat. L'annexe comprend toutes les statistiques sur les prises et l'effort de pêche pour chaque combinaison de mois et de zone statistique.

Mots-clés : saumon, poisson de fond, enquête de pêche sportive, prises, effort, composition par âge, distribution de longueur.

1.0 INTRODUCTION

This report documents the 1990 catch and effort statistics for the Strait of Georgia sport fishery and presents the methodology for collecting these data. It is one of a series of annual reports documenting the activities of the creel survey and providing official Strait of Georgia tidal sport fishery catch statistics. A list of previous reports in this series may be found in Appendix E. In this report all figures, tables and appendices are located at the end of text.

1.1 BACKGROUND

The Strait of Georgia creel survey study area (see Appendix C for a complete description) comprises over 5,900 km^2 (2,300 square miles) of water surface area and has in excess of 2,400 km (1,500 miles) of shoreline. From its southern end near Victoria, the area extends about 290 km (180 miles) north-west to the Campbell River area. At its greatest width this area is about 32 km (20 miles) wide. Two major population centers, Vancouver and Victoria, and many smaller centers such as Nanaimo and Campbell River are located within the study area. Over 500 boat launch ramps, marinas and public wharfs as well as thousands of private boat launching facilities provide access to this area.

The recreational fishery is active throughout the year but over 85% of the effort occurs in the summer months of May to September. It has become a major tourist attraction and a dominant economic force in some communities during the summer.

The size of vessel, method of fishing and terminal tackle vary widely depending on location and time of year. Vessels range from 4 m (12') car-top boats to yachts more than 17 m (50') in length, although most boats would be in the 5 m to 8 m (16' to 24') range. Popular fishing methods include trolling, mooching, bucktailing and stripcasting.

The most sought after species in the Strait of Georgia recreational fishery are the coho (O. kisutch) and chinook (Oncorhynchus tshawytscha) salmon, but in recent years significant fisheries directed at pink (O. gorbuscha) and sockeye (O. nerka) salmon have developed in certain areas.

Over the past 3 decades the recreational fishery in this area has undergone dramatic changes. Prior to 1960, the numbers of chinook and coho taken by the commercial troll fleet was almost double that taken by sport fishermen. Now, however, the situation is reversed with the sport fishery taking more than triple the commercial harvest of chinook and coho (comparable 1990 commercial troll catch: 173,700 coho and 34,200 chinook, Ryall and Shardlow 1991). The recreational fishery is now the primary

harvester of chinook and coho in the Strait of Georgia. Effort in the recreational fishery has increased from about 200,000 boat trips in 1960 to about 600,000 boat trips in recent years. Although annual coho catches have varied widely, an increase from about 200,000 pieces in 1960 to over 600,000 pieces in 1990 was recorded. In contrast, the chinook catch climbed through the 1960's but then declined steadily from a peak in the mid 1970's of over 400,000 pieces to its present level of just over 100,000 pieces.

From 1956 to 1976, estimates of catch and effort in the sport fishery published by the Department of Fisheries and Oceans (DFO) were based on subjective assessments completed by Fishery Officers and on small scale creel surveys. The general lack of statistical rigor and consistency associated with these methods of catch estimation as well as the rapid growth of the recreational fishery led to the initiation of the Strait of Georgia Creel Survey Pilot Program in 1980 (DPA 1982). The survey has been run continuously (with minor interruptions) since then. Although many details such as sampling locations and times are updated continuously to reflect changes in the fishery, the basic design of the survey remains similar to the pilot project conducted in 1980.

Creel survey data are used for a variety of management and reporting purposes. Catch and effort information is also used by local people (both inside and outside DFO) to monitor the fishery in their area. Creel survey information is also used predict the effect of proposed regulation changes and to measure the success of conservation actions imposed. The adipose mark information collected during the survey is supplied to the Mark Recovery Program (Kuhn et al 1988) and used in combination with other data for exploitation rate and stock distribution analyses.

1.2 OBJECTIVES

The specific objectives of the 1990 Strait of Georgia creel survey were:

1. To estimate the sport angler effort and catch of chinook, coho, pink, sockeye and chum salmon, rockfish, lingcod and other finfish by month for Statistical Areas 13-19, 28 and 29; and to estimate the number of chinook and coho released by anglers.

2. To estimate the mark rate for adipose clipped chinook and coho in the catch.

3. To estimate the age composition and mean length-at-age for chinook, and the length frequency for coho.

4. To estimate the species composition of the rockfish catch.

2.0 METHODS

2.1 STUDY DESIGN

The design of the Strait of Georgia Creel Survey conducted in 1990 was similar to that used by DPA Consulting Ltd. (1982) with some modifications to the data analyzed, sampling intensity, flight routes and data processing. It is comprised of two independent surveys: angler interviews and aerial overflights. Angler interviews provide data on sport fishing catch per unit effort (CPE) and daily activity patterns. Aerial overflights provide estimates of the total sport fishing effort in the study area at the time of the aerial survey. These data are combined to provide monthly estimates of total sport fishing effort and total catch of salmon and groundfish in the sport fishery. In its simplest form, the estimated total catch is calculated by multiplying the estimated total effort by catch per unit effort.

The fishery was stratified according to the following criteria:

1. Month. The survey operated during all months of the year, but estimates were produced for 10 time periods. January and February data were grouped together, as were November and December data because of reduced fishing activity during these months.

2. Geographic area. Catch and effort estimates were produced for Statistical Areas 13-19, 28 and 29. Statistical Area 19 was split into Area 19A (Saanich Inlet - see Fig. C-1 in Appendix C) and 19B+ (the rest of area 19 and that portion of Area 20 east of Sheringham Point.

3. Day type. Weekend and mid-week days were considered independently because sport fishing activity is known to differ for the two types of days.

4. Time of day. Sampling shifts (one shift is a set number of hours of interviewing anglers at one site by one creel surveyor) were conducted during set time periods. From March to October sampling was conducted during either an early shift (approximately 0700 to 1500) or a late day shift (approximately 1500 to 2300). During the winter months of January, February, November and December only one shift timing was used (approximately 1000 to 1700).

5. Guided verses unguided anglers. Although it was impossible to allocate sampling effort in advance to guided and unguided anglers, data from these two types of boat trips were considered independently. Unpublished data from previous surveys in this series confirm that the CPUE from guided boats differs markedly from unguided boats.

In each region, various landing sites were chosen as locations for surveyors to conduct interviews. Site selection was based on 4 criteria: representativeness, traffic volume, site accessibility and adequate observation points. Discussions with local fishermen, marina operators and Fisheries Officers and data from previous surveys were used to choose sites that were representative of the local sport fishing activity (ie. sites which were used by a good cross-section of anglers). Sites with expected traffic volumes of more than 15 boats per day in the summer were considered as possible sampling locations. Expected traffic volumes for sites were compiled from previous surveys or from discussions with marina operators or local Fisheries Officers. Site accessability refers to whether a site can be reached easily by car or ferry during the defined shift hours. Only sites with good accessability were selected. As a result, landing sites on most of the islands in the Strait of Georgia were excluded from the survey. This was not expected to be a major factor, however, since most of the fishing that occurs in these areas is from boats launching from an accessible site. The final criterion, adequate observation points, was essential for interviewers to obtain an accurate count of all boats returning to a landing site. At some large marinas, where the number of access points made it impossible to see all boats returning, the facility was defined and sampled as two separate sites.

Allocation of sampling effort among months followed the same general pattern as fishing effort, that is, more effort was allocated during the summer when fishing effort is at its highest. Allocation of sampling effort among regions (groups of Statistical Areas) also followed fishing effort patterns. Within each month, each chosen site was allocated between 6 and 10 shifts. These shifts were divided equally among weekend and mid-week days and early and late daily time periods.

Data collection, entry and preliminary processing were conducted by LGL Ltd. environmental research associates. Estimation of the catch and effort statistics was conducted by the Department of Fisheries and Oceans.

2.1 DATA COLLECTION

2.11 Angler Interviews

Surveyors were stationed at access points for scheduled shifts to interview anglers as they returned from fishing. The number of boats returning to a site during a shift as

well as the number of interviews attempted and completed were recorded on a tally sheet. For each boating party landing, the following information was recorded on an interview form (Fig. 3):

1. Total number of anglers in the boat.
2. Time of landing.
3. Whether the party had been sport fishing.
4. Whether the party was guided.
5. Residency of anglers.
6. Time during which fishing lines were in the water.
7. Average number of lines in the water.
8. Total number and species of kept and released fish for each of 3 sub-Statistical Areas.
9. Number of hours spent fishing in each sub-Statistical Area.
10. Number of marked and unmarked chinook and coho in the catch.
11. Number of hours directed at each species.

Interviewers were trained in fish identification and inspected each boating party's catch. Landed chinook and coho were checked for a missing adipose fin which indicates the presence of a coded wire tag embedded in the fish nose cartilage. In addition, scale samples for age determination and measurements of nose-fork length were taken during every sampling shift. Five scales were removed from the INPFC (International North Pacific Fisheries Commission) preferred area of each biosampled chinook (Mosher 1968).

In 1990, interviews were conducted each month at a maximum of 39 of the 50 designated landing sites (boat ramps, marinas, or resorts, Appendix C) representative of the sport fishing activity in each Statistical Area. The number of sites selected in each area was dictated by targets of desired precision and number of surveyors available. For each area - day type - work block stratum, sampling shifts at a site were chosen on a near random basis from the total number of shifts available. For definition of the above terms (day type, work block, shift) see Appendix A.

2.12 Aerial Overflights

Aerial surveys, conducted from float planes travelling along pre-defined routes, allowed observers to count vessels actively sport fishing throughout the Strait of Georgia. Planes flew at an altitude of 150-210 m (500-700 feet) to facilitate a broad range of vision and still allow easy identification of vessel characteristics. Each plane carried three observers, two on the right side and one on the left, and each observer counted sport fishing boats to his/her side of the flight path. Figure 2 shows the flight paths used in 1990. The winter (October - April) flight path was slightly reduced to correspond with the lower winter effort.

The flight path and time of departure were designed to cover major concentrations of sport fishing activity at peak periods. Whenever possible, the route was flown to keep most of the sport fishing boats to the right side to allow averaging of the two right side counts. To maximize precision, flying times during which fishing effort was rapidly changing were avoided. The number of overflights each month was governed by targets of desired precision and by the expected number of interviews from a given number of sampling shifts (English et al. 1986). The days for overflights during a month were randomly selected for each day type.

2.2 DATA ANALYSIS

Data analysis included calculation of catch and effort statistics, calculation of variance of total fishing effort and total catch, estimation of marked chinook and coho salmon, estimation of age and length composition of chinook catch and length frequency distribution of coho and lingcod catch. Appendix A details the methods and equations used in the above data analysis.

3.0 RESULTS

3.1 DISTRIBUTION OF SAMPLING EFFORT

Table 2 shows the number of creel survey interviews conducted with anglers who had been actively fishing by month and Statistical Area in 1990, and the number of monthly overflights. A total of 32,505 interviews, of which 25,088 involved actively fishing anglers, and 68 overflights were conducted in 1990. Figure 4 shows that the monthly distribution of interviews generally reflected the monthly distribution of fishing effort (number of boat trips, Table 3). Interview effort was reduced during winter months, especially for Statistical Areas 13, 14 and 15 in the northern portion of Strait of Georgia (Table 2). The total interviews represent 6.0% of the estimated total fishing effort for the entire study area (543,368 boat trips, Table 3). The interviews involving actively fishing anglers represent 4.6% of the total fishing effort and ranged in each Statistical Area from a low of 2.0% of the estimated fishing effort in Area 18 to a high of 8.9% in Area 28 (Tables 2 and 4).

3.2 SPORT FISHING EFFORT AND CATCH

The 1990 Strait of Georgia sport fishing effort and catch statistics are summarized for each species by month in Table 3 and by Statistical Area in Table 4. Appendix B shows the fishing effort and catch statistics by species for each combination of month and Statistical Area.

Sport fishermen made 543,368 boat trips during 1990 which is lower than the average fishing effort in recent years (Fig. 1, Table 1). The fishing effort followed the same general seasonal pattern as seen in previous years (Table 3, Fig. 5). Effort levels climbed steadily from April, peaked in July and August, and declined rapidly in September and October.

The total finfish sport catch in the Strait of Georgia was estimated at 1,006,411 pieces (including steelhead and cutthroat trout, Table 3) and consisted of 78% salmon and 22% groundfish. An additional 704,554 salmon of mixed species were released by anglers (Appendix B-8). Salmon and groundfish catches are discussed below.

3.21 Salmon

Salmon sport catches in the Strait of Georgia in 1990 totalled 787,142 pieces (Tables 3 and 4) and consisted of 80% coho, 14% chinook, 1.5% pink salmon, 4% sockeye and less than 1% chum salmon.

In 1990, anglers took 111,914 chinook (Tables 3 and 4), compared to 132,846 in 1989 and 119,117 in 1988 (Fig. 1, Table 1). Monthly chinook catches peaked in June and then declined steadily (Fig. 6, Table 3). Seasonal catch efficiency for chinook showed patterns similar to those in 1988 and 1989, averaging 0.2 fish per boat trip and peaking in the winter months at 0.9 fish per boat trip (Fig. 7, Table 5).

The continued low chinook catch and the reduced catch efficiency were probably a result of a continued low abundance of this species and, to a lesser extent, the sport fishery regulations introduced in 1989 (Collicutt and Shardlow 1990).

Chinook regulations in place during 1990 in the Victoria area (Cadboro Point to Sheringham Point near Sooke) included a size limit of 45 cm and an annual bag limit of 20. In the remaining portion of the Strait of Georgia the size limit was 62 cm and anglers were restricted to 15 chinook per year. See Appendix C for a definition of the study area.

The spacial distribution of chinook catch followed a similar pattern to previous years. The highest catches were taken in Area 19B+ (27% of total), Area 13 (26%), and Area 14 (16%) (Table 4, Fig. 8). In 1990, 77% of the chinook landed during the summer months (May - September) were taken in the northern region of Strait of Georgia - Statistical Areas 13 to 17. The opposite was true in the winter months (January - April, October - December) when 76% of the winter catch came from the southern region - Statistical Areas 18, 19, 28 and 29 (Appendix B-3). During November and December, most of the chinook came from Victoria/Sooke waters in Statistical Area 19B+ (Appendix B-3).

The 1990 coho catch was 630,032 pieces (Tables 3 and 4). Monthly coho catches peaked in June which is somewhat earlier than in 1989 but similar to 1988 (Fig. 9). Coho catch success reached a high of 2.1 fish per boat trip in June, and showed a secondary peak of 1.2 fish per boat trip in October (Fig. 10, Table 5). As in previous years, the highest coho catches were taken in Area 13 (40%) and Area 14 (31%) (Table 4, Fig. 8).

In 1990, Strait of Georgia anglers caught 11,549 pink salmon (Table 3). Significant pink catches were not expected in 1990 because pink salmon returns to the Strait of Georgia rivers (primarily the Fraser River) are much higher in odd numbered compared to even numbered years. The highest catches were taken in Area 13 (78% of total) and Area 14 (17%) (Table 4).

The landings of other salmon consisted of an estimated 30,669 sockeye and 2,978 chum salmon (Table 3). A large portion of the annual sockeye catch (82% of total) was taken in Areas 19B+, 28 and 29 during August (Appendix B-5). Most of the annual catch of chum salmon (74% of total) was taken in Area 13 during September and October (Appendix B-6).

In addition to the above salmon species, an estimated 5,298 steelhead, cutthroat trout and unidentified salmon were caught in the Strait of Georgia in 1990, bringing the total salmonid catch to 792,440 pieces (Appendix B-7).

The average number of salmon caught during each boat trip in 1990 was 1.45 (Table 5). As seen below, this value is within the range of averages seen in recent years.

Year	Catch Success	Reference
1985	1.69	Shardlow and Collicutt (1989 a)
1986	1.30	Shardlow and Collicutt (1989 b)
1987	1.47	Shardlow and Collicutt (1989 c)
1988	1.86	Shardlow and Collicutt (1989 d)
1989	1.28	Shardlow and Collicutt (1989 e)
1990	1.45	This report

In 1990, Areas 13 and 14 showed the highest effort expended and the most salmon landed (Fig. 11, Table 4). Boaters fishing in Areas 13 and 14 had an average catch of 2.4 and 1.6 salmon per trip respectively (Table 4). Area 14 recorded the greatest number of salmon hooked and released (226,857) with Area 13 next at 191,552 (Appendix B-8). These two areas have major coho fisheries characterized by the release of many sub-legal coho.

3.22 Groundfish

While salmon accounted for the majority of the total finfish sport catch in the Strait of Georgia in 1990, the groundfish catch of 219,269 pieces made up 22% of the overall catch (Tables 3 and 4). The species composition of the groundfish catch, based on the Table 4 data, was as follows:

Groundfish Species	Catch	% of Total Groundfish Catch	Major Catch Area
Rockfish (Sebastes spp.)	154,858	71%	16
Lingcod (Ophiodon elongatus)	31,716	15%	13
Dogfish (Squalus acanthias)	2,679	1%	14
Other finfish (Appendix D)	30,016	13%	19B+
Total	219,269	100%	

The majority of the groundfish catch was taken in the summer months, reflecting the seasonal change in fishing effort (Table 3, Fig. 4). Catch by Statistical Area for rockfish was highest in Area 16 (28% of total, Table 4). Lingcod, as in previous years, were caught in greatest numbers in Area 13 (43% of total), while the largest dogfish catch came from Area 14 (20% of total, Table 4). Area 19B+ produced the largest catch of other finfish (36%).

Rockfish species were identified for the entire survey area again in 1990 (Table 6). Applying the identification results to the 1990 rockfish catch estimates by area (Table 4) showed the catch by species and area (Table 7). The results are summarized below.

Rockfish Species	Catch	% of Rockfish Catch	Major Catch Area
Quillback	49,437	32%	16
Copper	29,903	20%	14
Yelloweye	6,264	4%	14
Black	2,215	1%	19B+
Other	67,039	43%	16
Total	154,858	100%	

The above "other" rockfish category consisted of tiger, yellowtail, china, canary and unidentified species.

The catch success (CPE) for rockfish was relatively constant throughout the year and averaged 0.28 fish per boat trip, while the catch success for lingcod was 0.06 fish per boat trip (Table 5). The catch success for all non-salmon species and for total finfish during 1990 was 0.4 and 1.85 fish per boat trip respectively (Table 5).

3.3 BIOLOGICAL DATA

3.31 Proportion and Catch of Marked Chinook and Coho

In 1990, 5,343 chinook and 27,164 coho were examined for adipose fin clip marks. Tables 8 and 9 show for chinook and coho respectively, the number of marks observed and the total fish inspected by month and region. The data were presented by region since some Statistical Areas had insufficient numbers of fish examined for marks in some months, and those data were included with other Areas. Three regions were defined: the North Gulf represented by Areas 13-16; the South Gulf represented by Areas 17, 18, 28, 29 and the Saanich Inlet portion of Area 19 (Area 19A); and the Victoria region represented by the remainder of Area 19 (Area 19B+) (Fig. 2).

Among chinook examined for marks, 4.2% had adipose fin clips. The largest observed proportion of chinook marks was in the North Gulf catch (0.053) and the lowest proportion in the Victoria catch (0.028) (Table 8). Among coho examined for marks, 3.2% had adipose fin clips. The largest observed proportion of coho marks was in the South Gulf catch (0.035), and the lowest proportion in the North Gulf catch (0.031) (Table 9).

Monthly catch estimates of marked chinook and coho are shown by region in Tables 10 and 11 respectively. The seasonal recovery pattern of marked chinook and coho salmon was generally similar to that observed in previous years (Shardlow and Collicutt 1989 b, c and d).

3.32 Catch-At-Age for Chinook

During 1990, 1,491 chinook biosamples were collected for age and length analysis. As in 1989, sampling took place during every shift instead of every second shift resulting in more samples than in previous years. Table 12 shows the monthly number and percent age composition of chinook sampled for age. All ages shown in this report represent the total age (freshwater age plus saltwater age). The age data are summarized graphically in Figure 12. The monthly age proportions were applied to the estimated monthly chinook catches to provide a breakdown by age group (Table 13). In 1990, the chinook sport catch in the Strait of Georgia consisted primarily of age 4 fish (53.9%), followed by age 3 fish (36.4%), age 2 fish (7.5%) and age 5 or older fish (2.2%). 1990 is the first year in which age 4 fish were such a dominant part of the catch (see below).

	% Age Composition of Chinook				
Catch Year	2	3	4	5+	Reference
1983	57.1	25.5	14.2	3.1	Shardlow et al. (1989)
1984	21.6	67.3	9.4	1.7	Shardlow and Collicutt (1989 a)
1985	6.6	70.8	20.6	2.0	Shardlow and Collicutt (1989 b)
1986	10.9	44.9	40.4	3.8	Shardlow and Collicutt (1989 c)
1987	7.8	62.1	25.0	5.2	Shardlow and Collicutt (1989 d)
1988	26.4	35.3	35.4	2.8	Shardlow and Collicutt (1989 e)
1989	3.1	83.3	10.5	3.1	Collicutt and Shardlow (1990)
1990	7.5	36.4	53.9	2.2	This report

The strong age 3 component in 1989 and age 4 component in 1990 were likely a result of a strong brood year.

Figure 12 and Table 12 show a shift in the age composition of sampled chinook, and hence of chinook catch, as the year progressed. Age 4 fish were the dominant component of the catch until August, after which age 2 and 3 fish made up most of the catch.

3.33 Mean Length-At-Age for Chinook

Table 14 shows the monthly mean nose-fork length at age for the 1,491 chinook for which both length and age data were available. Figure 13 shows the length frequency distribution for all the measured chinook (1,820 aged and unaged fish). The largest portion of measured chinook (1,257 fish or 69% of the total sample) was in the 62-71 cm and 72-81 cm length categories (the basis for using these size categories was the 62 cm size limit). This is consistent with the large catch of age 4 and 3 fish (Table 13) which were found to have an annual mean length of 73.9 cm and 65.8 cm respectively (Table 14). Of the total chinook measured in 1990 in the Victoria area (19B+), 1% (5 out of 392 sampled fish) were sub-legal in size (less than 45 cm). In the remaining portion of the Strait of Georgia, 10% (143 out of 1,428 sampled fish) were sub-legal (less than 62 cm). By comparison, only 2 - 3% of the chinook sampled during the 1985 to 1987 surveys were sub-legal (less than 45 cm) (Shardlow and Collicutt 1989 b, c and d). While the number of sub-legal fish observed in the Strait of Georgia area still appears to be relatively high because of the introduction of the 62 cm size limit, it has dropped substantially from 1989 (20%, Collicutt and Shardlow 1990). The largest chinook sampled (109 cm) was a 5 year old fish landed at Campbell River Boat Rentals in Statistical Area 13 on August 5, 1990.

3.34 Length Frequency Distribution for Coho

Figure 14 shows the length frequency distribution for coho sampled in 1990. In 1990, the largest proportion of measured coho (5,123 fish or 57% of the total sample) was in the 50-59 cm length class. This is similar to previous years when 55%, 53% and 42% (1987 to 1989 respectively) of the measured coho were in this size class. In the 1989 report (Collicutt and Shardlow 1990) an overall decline from 1986 to 1989 in the size of landed coho was noted. This trend does not appear to have continued in 1990 as shown below.

Year	Mean Length (cm)	Sample Size
1986	53.4	5,354
1987	50.5	4,997
1988	50.0	13,000
1989	49.6	6,883
1990	51.4	8,959

3.35 Length Frequency Distribution for Lingcod

Figure 15 presents the length frequency distribution for lingcod sampled in 1990. The largest proportion of measured lingcod (124 fish or 40% of the total sample) was in the 50-59 cm length class. This is similar to previous years when 37%, 42%, 39%, 39%, and 39% (1985 to 1989 respectively) of the measured lingcod were in this length class.

4.0 SUMMARY

A sport fishery creel survey was conducted in the Strait of Georgia in 1990 in order to estimate the catches of all the important recreational finfish species and the total sport fishing boat trips. The numbers of chinook and coho salmon with adipose fin clips were also estimated. These data are presented by month and Statistical Area. The age composition of chinook and the length frequency distributions of chinook, coho and lingcod are also shown.

In 1990, sport fishermen made an estimated 543,000 boat trips in the Strait of Georgia. A total of 32,505 boating parties, of which 25,088 were actively fishing, were interviewed at a monthly maximum of 39 landing sites in the Strait of Georgia Creel Survey area. This sampling represents approximately 6% of the total number of boat trips conducted by sport fishermen in the Strait of Georgia in 1990. A total of 68 overflights were also conducted to take "snapshot" counts of fishing effort.

In 1990, sport fishermen in the strait of Georgia landed an estimated total finfish catch of 1,006,411 pieces of which 78% were salmon and 22% were groundfish. The 788,000 landed salmon consisted of 630,000 coho, 112,000 chinook, 12,000 pink salmon, 31,000 sockeye and 3,000 chum salmon. An additional 705,000 salmon of mixed species were released by anglers.

The 220,000 landed groundfish consisted of 155,000 rockfish, 32,000 lingcod, 3,000 dogfish and 30,000 other finfish. Rockfish catches were identified as quillback (32% of rockfish catch), copper (20%), yelloweye (4%) and black (1%); the remaining 43% of the rockfish catch consisted of tiger, yellowtail, china, canary and unidentified species.

Catch success per boat trip averaged 1.5 salmon (all species) and 0.4 groundfish.

Among salmon examined for marks, 4.2% of chinook and 3.2% of coho had adipose fin clips. The majority of chinook sport catch in 1990 consisted of age 4 fish (53.9%), followed by age 3 (36.4%), age 2 (7.5%) and 5 or older (2.2%). Of the total chinook measured in 1990, 1% were sub-legal in size (less than 45 cm) in the Victoria area and 10% were sub-legal in size (less than 62 cm) in the remaining portion of the Strait of Georgia. Of the coho and lingcod sampled for length, the largest proportion for both species was in the 50-59 cm size class.

5.0 ACKNOWLEDGMENTS

We would like to thank the creel survey staff of LGL Ltd., particularly Karl English, Gary Searing and Jill Peterson, and private marina and boat ramp owners for their valuable assistance and cooperation. Thanks also to the many thousands of anglers who participated voluntarily in the survey.

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FIGURES

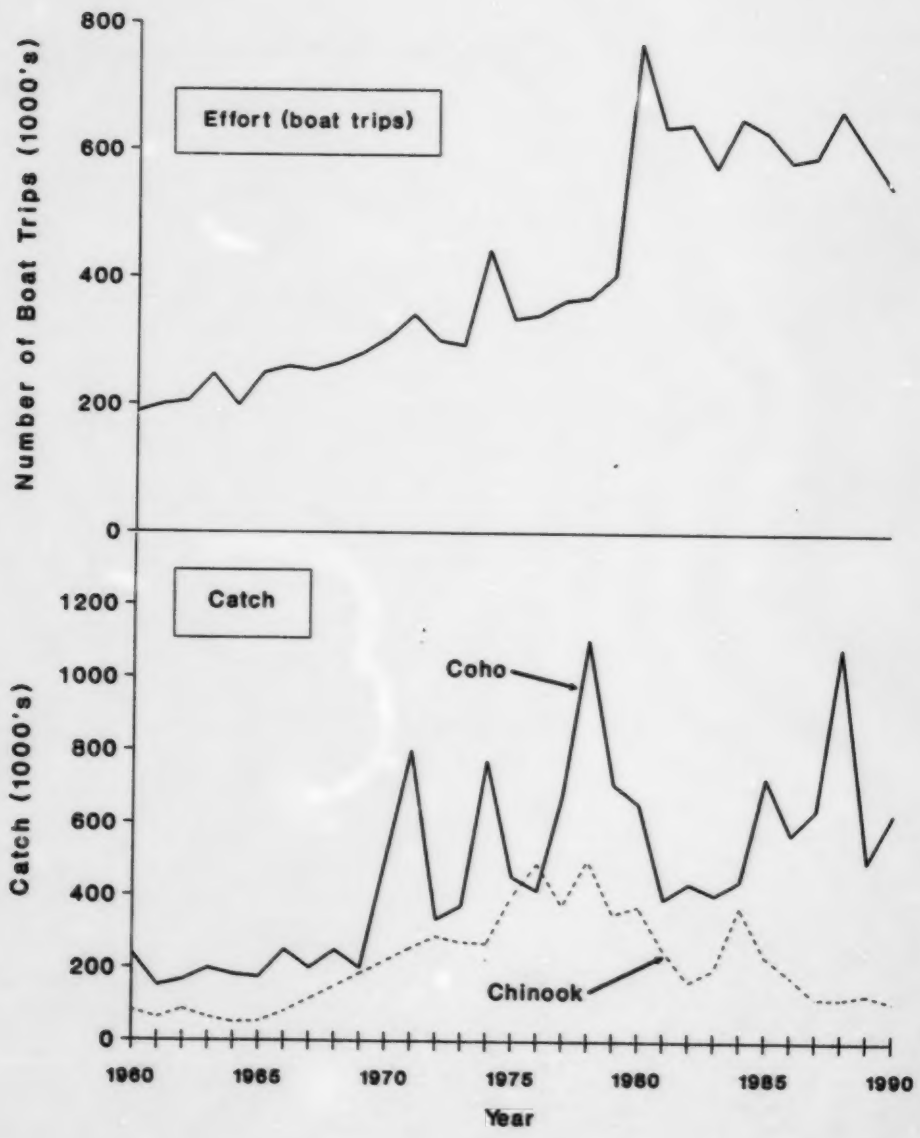

Figure 1. Tidal effort statistics and sport catches of coho and chinook salmon for the Strait of Georgia, 1960 - 1990.

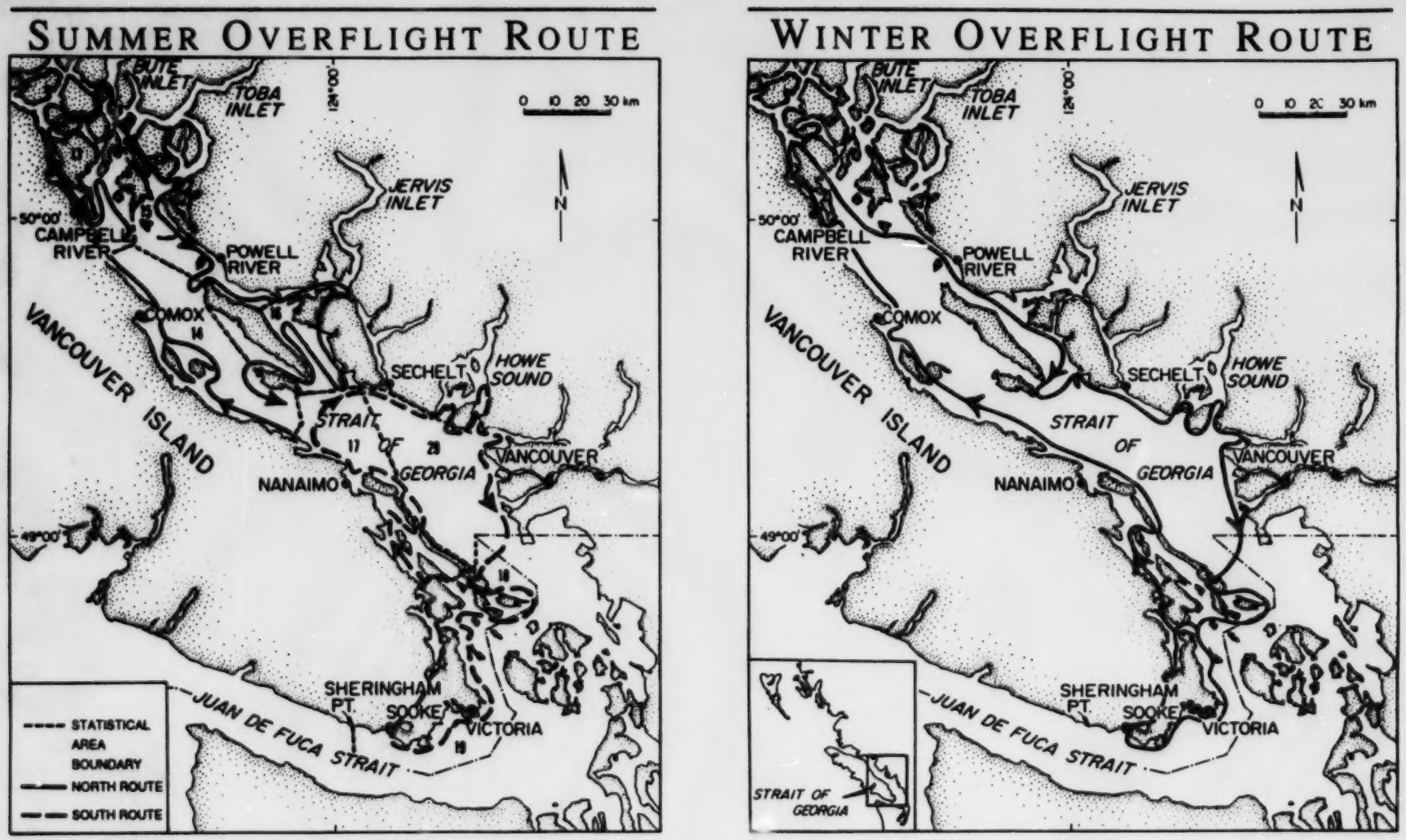

Figure 2. Summer and winter overflight routes, Strait of Georgia, 1990.

GEORGIA STRAIT SPORT FISHING CREEL SURVEY No. 27002

Landing Area: _____ / _____ Statistical Area: _____

Interviewer: _____ / _____ Date: ____ / ____ ____ (YR / MO DAY) Time of Interview ___ ___ AM PM

PRESENT BOAT TRIP COMPLETED

Assessment Code ☐
- 0 = Complete Form
- 1 = Marks Incomplete
- 3 = Not Visually Inspected
- 4 = Refusal

1. Total number of individuals in party: ☐
2. Time of landing: ____:____ AM PM Time block: ☐
3. Was your party sport fishing on this trip: YES NO
4. Guided: YES NO
5. Residences of party: B.C. ☐ Rest of Canada ☐ Other ☐
6. Length of boat trip: ☐☐ HRS.
7. Times lines were in the water: (EXCLUDE time not fishing)

☐ 1) Before 7:00	☐ 5) 10:00 - 10:59	☐ 9) 2:00 - 2:59	☐ 13) 6:00 - 6:59
☐ 2) 7:00 - 7:59	☐ 6) 11:00 - 11:59	☐ 10) 3:00 - 3:59	☐ 14) 7:00 - 7:59
☐ 3) 8:00 - 8:59	☐ 7) 12:00 - 12:59	☐ 11) 4:00 - 4:59	☐ 15) 8:00 - 8:59
☐ 4) 9:00 - 9:59	☐ 8) 1:00 - 1:59	☐ 12) 5:00 - 5:59	☐ 16) 9:00 - Plus

8. Average number of lines in the water for TOTAL boat party: ☐
9. CATCH SUMMARY

Total catch for trip: ☐

Total time fishing: ☐ HRS.

	1ST SUB AREA	2ND SUB AREA	3RD SUB AREA
GO TO MAP:			
KEPT:			
RELEASED:			
TIME:	HRS.	HRS.	HRS.

MARKS

	ADIPOSE MISSING	UNMARKED
CHINOOK	☐	☐
COHO	☐	☐

10. How much fishing time was directed at each of the following?

CO ☐ CN ☐ SM ☐ LC ☐ RF ☐
GF ☐ SF ☐ OTHER ☐

11. Released Coho Information:

TOTAL NUMBER RELEASED	# LEGAL SIZED COHO RELEASED		
	LARGER FISH WANTED	DAILY LIMIT REACHED	OTHER REASON
☐	☐	☐	☐

27002

Figure 3. Sample of 1990 interview form.

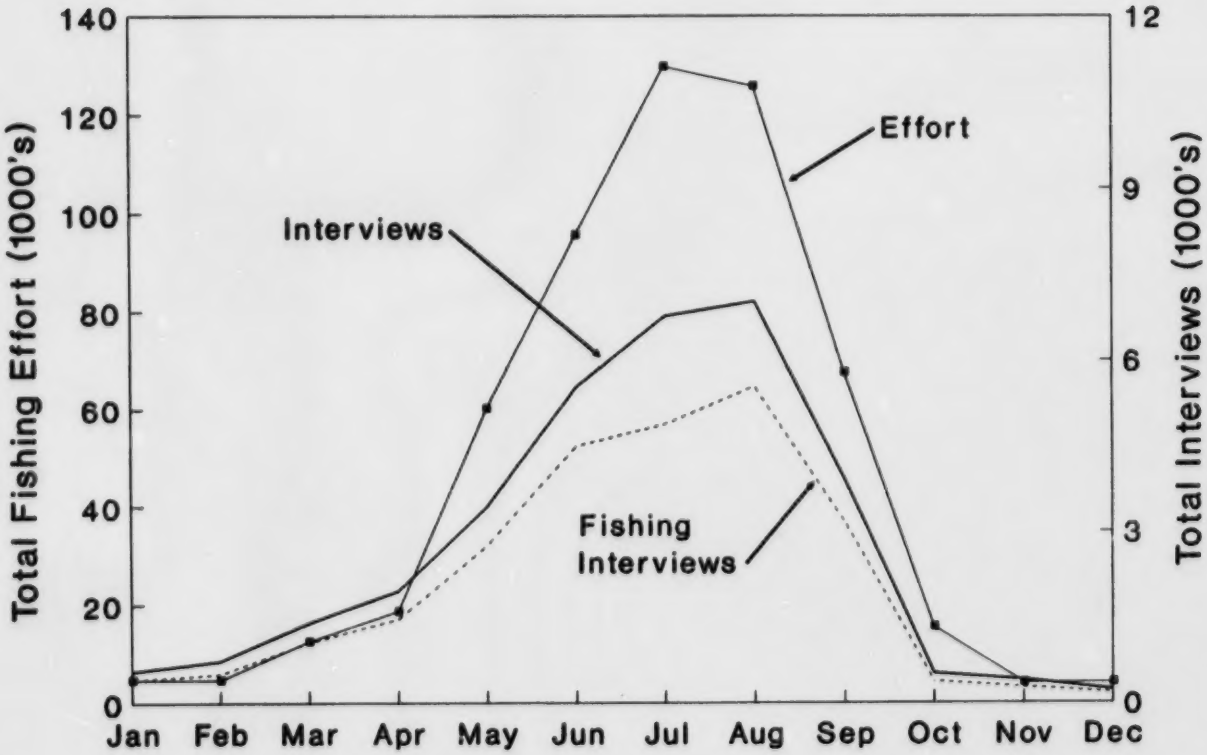

Figure 4. Comparison of monthly total fishing effort, monthly total interviews and monthly total fishing interviews, Strait of Georgia, 1990.

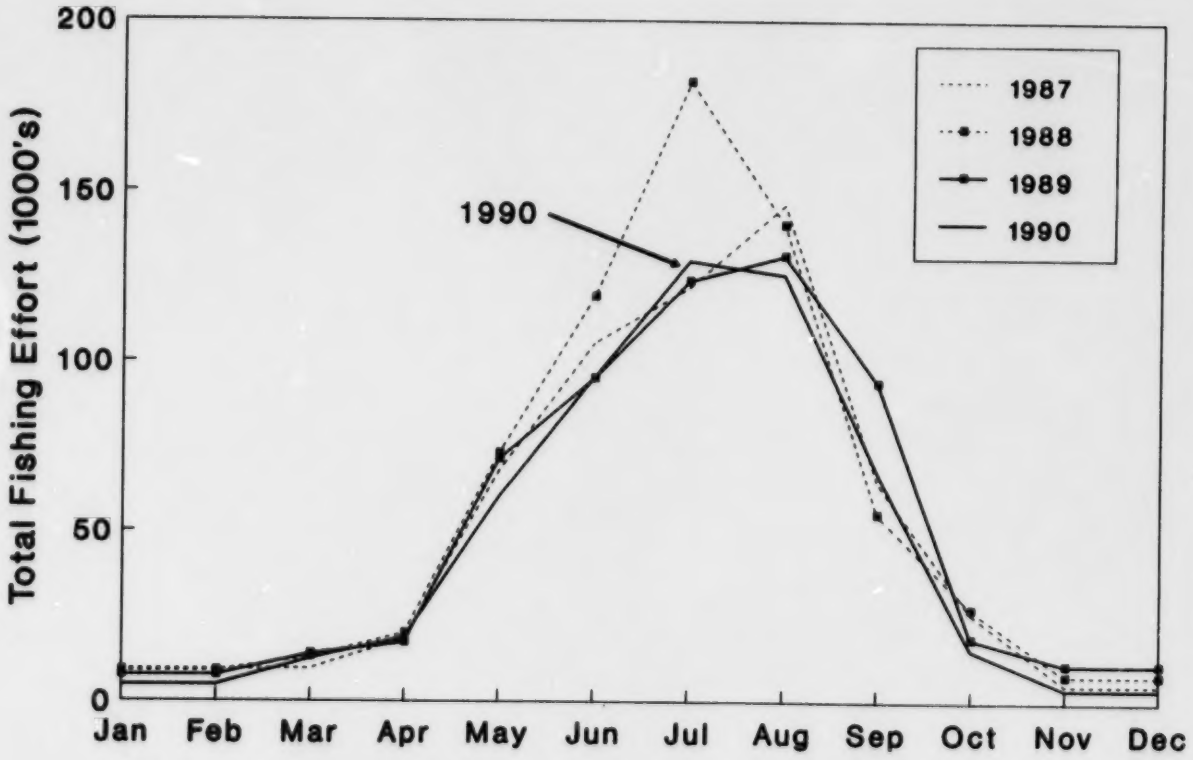

Figure 5. Monthly fishing effort estimates (number of boat trips) for the Strait of Georgia sport fishery, 1987 - 1990.

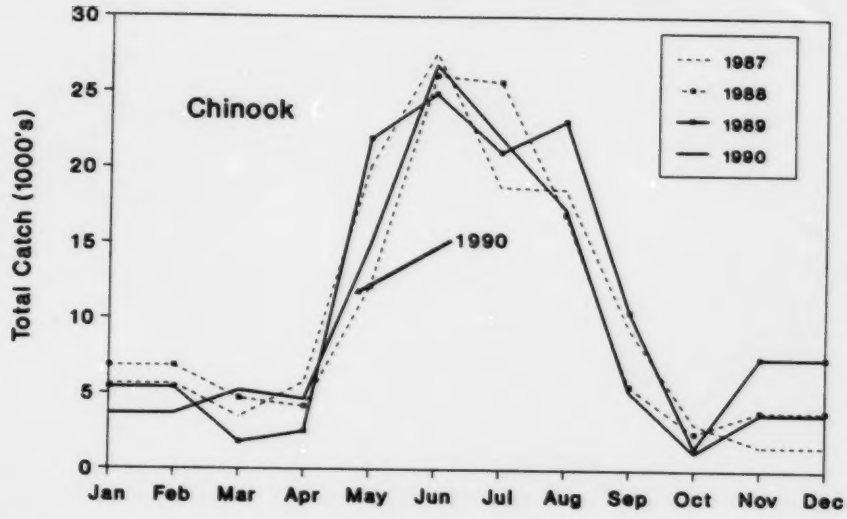

Figure 6. Monthly chinook catch for the Strait of Georgia sport fishery, 1987 - 1990.

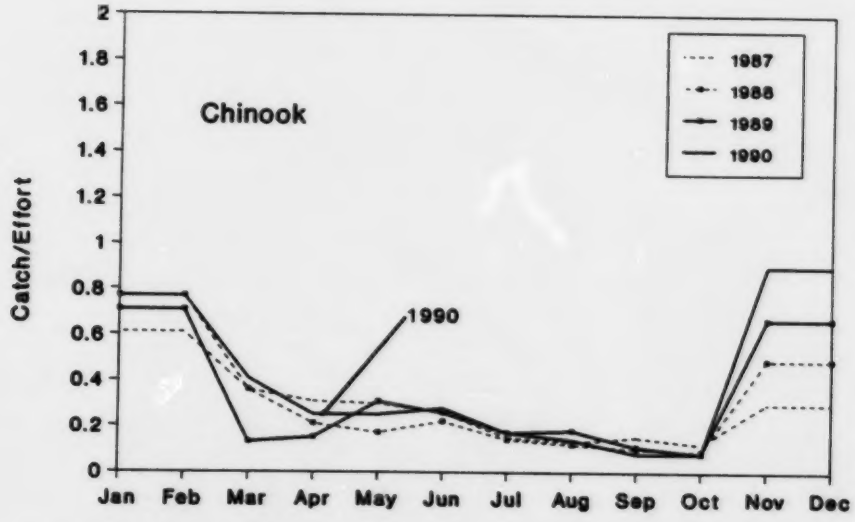

Figure 7. Monthly chinook catch per boat trip for the Strait of Georgia sport fishery, 1987 - 1990.

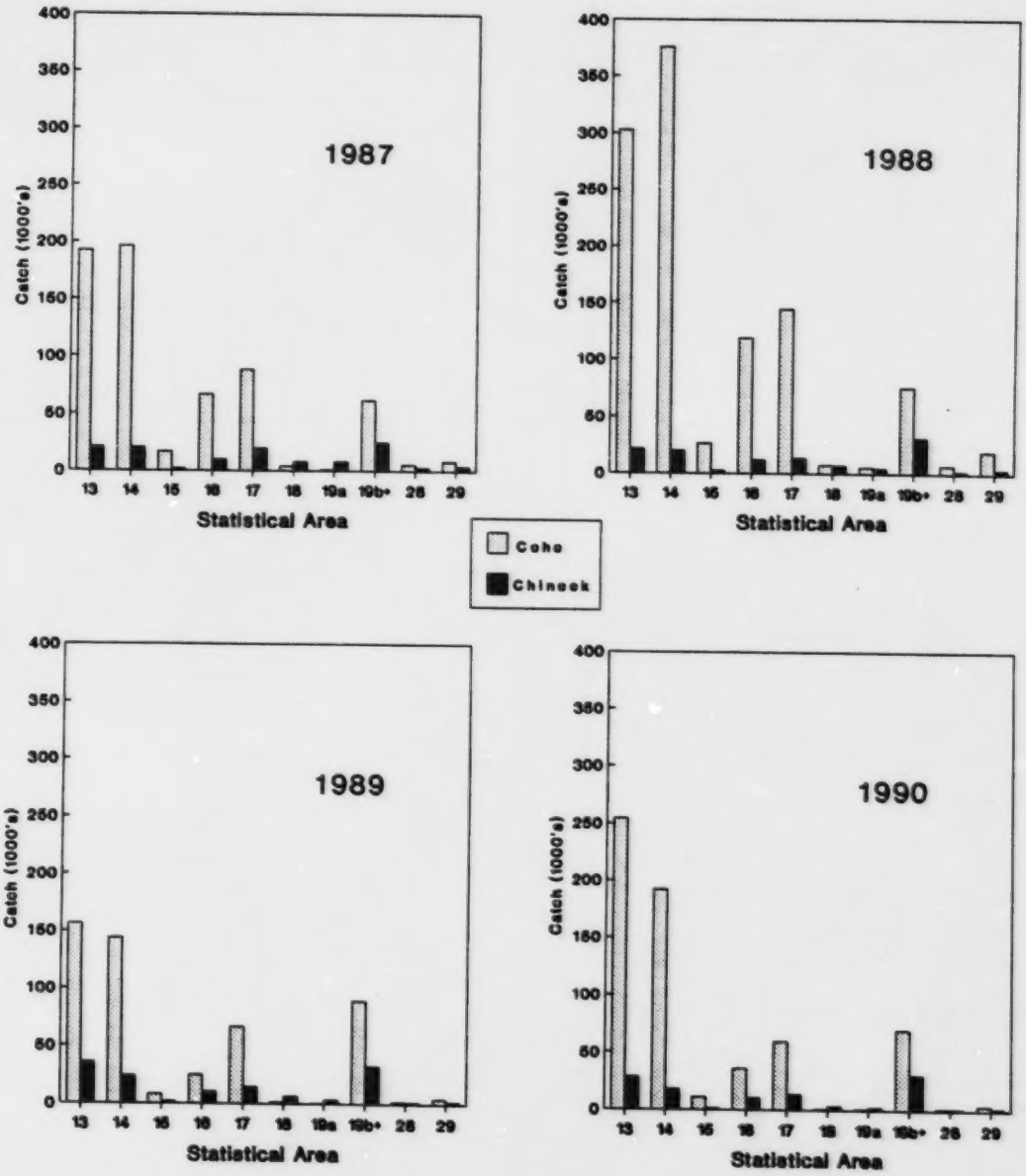

Figure 8. Annual sport catches of chinook and coho salmon by Statistical Area in the Strait of Georgia, 1987 - 1990.

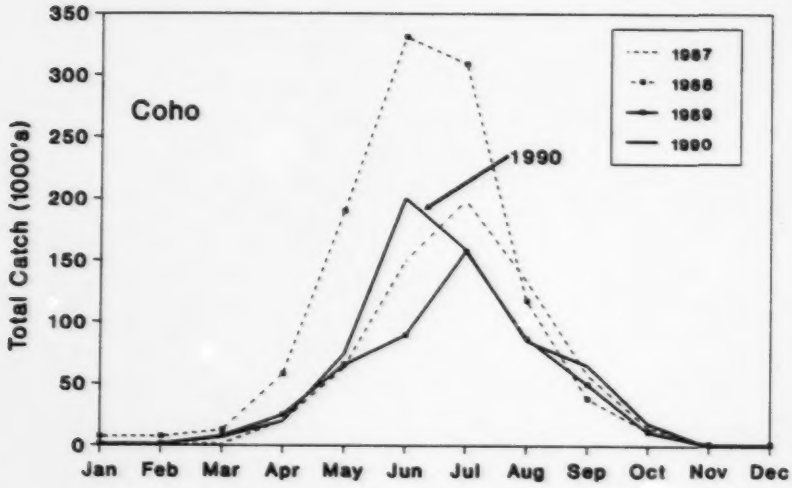

Figure 9. Monthly coho catch for the Strait of Georgia sport fishery, 1987 - 1990.

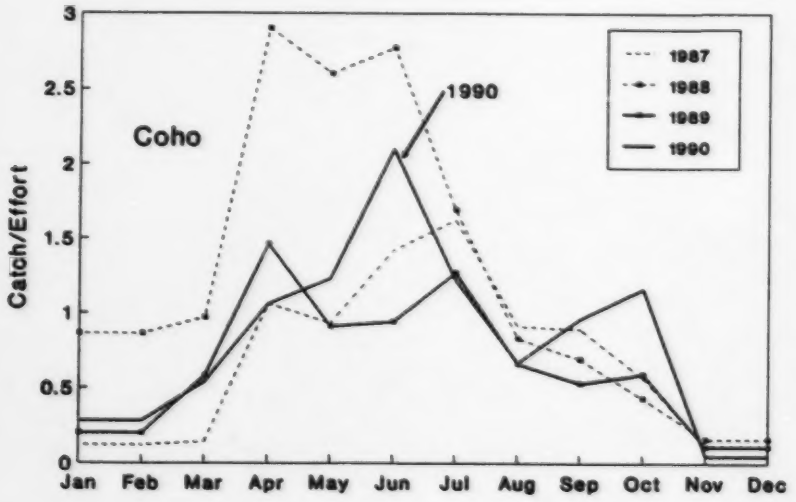

Figure 10. Monthly coho catch per boat trip for the Strait of Georgia sport fishery, 1987 - 1990.

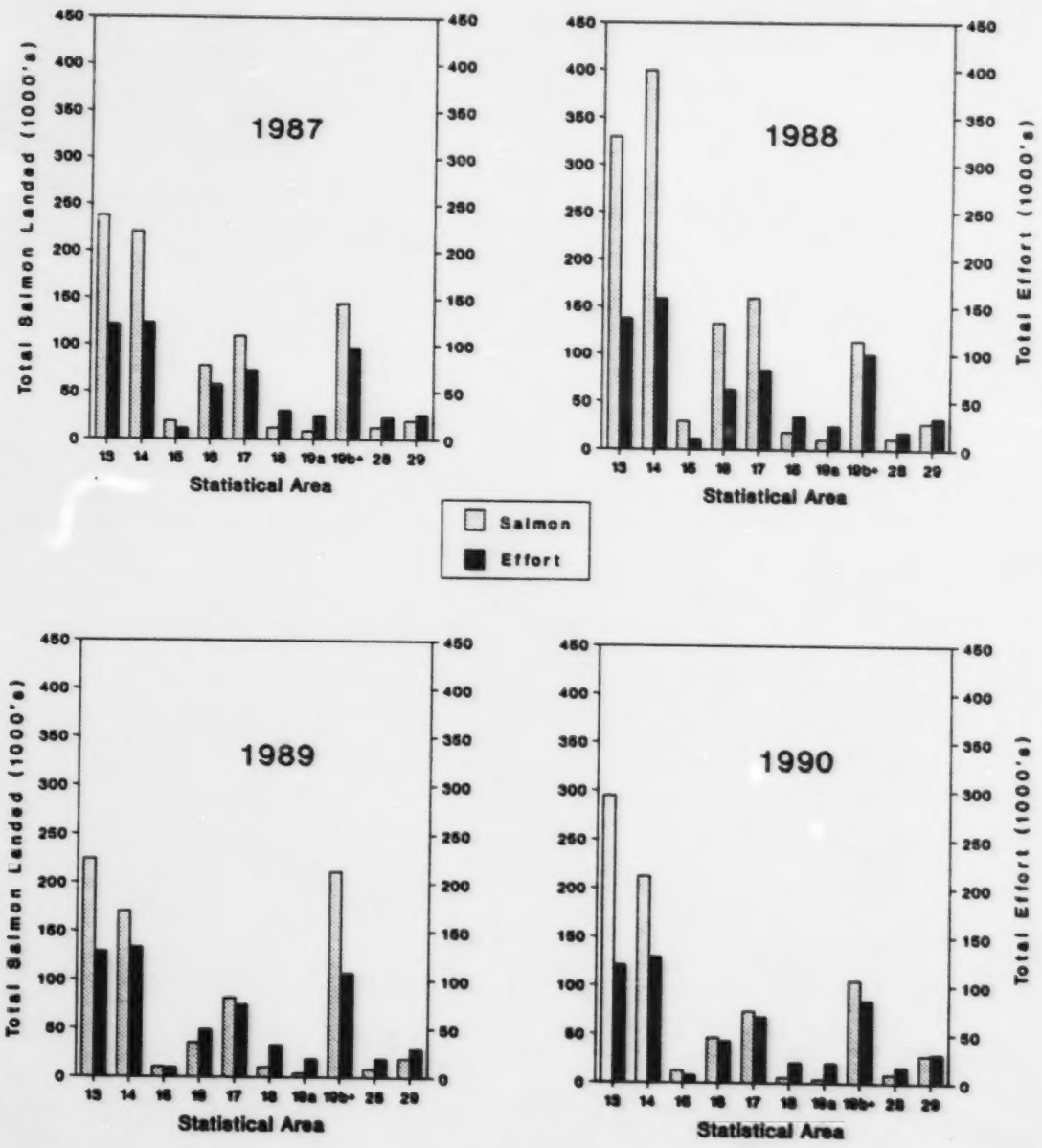

Figure 11. Total salmon landed and total fishing effort expended by Statistical Area in the Strait of Georgia sport fishery, 1987 - 1990.

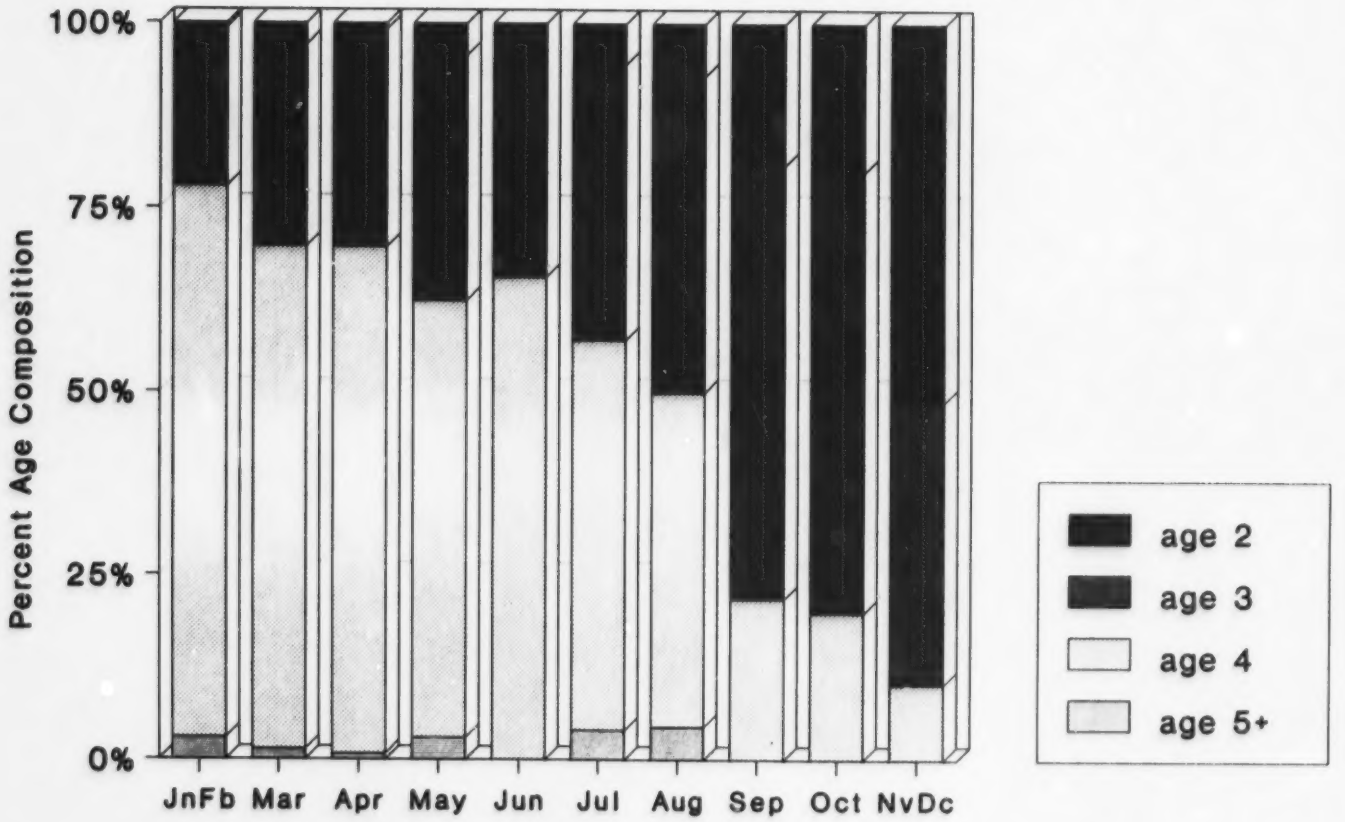

Figure 12. Monthly percent age composition of chinook salmon sampled in the Strait of Georgia Creel Survey, 1990.

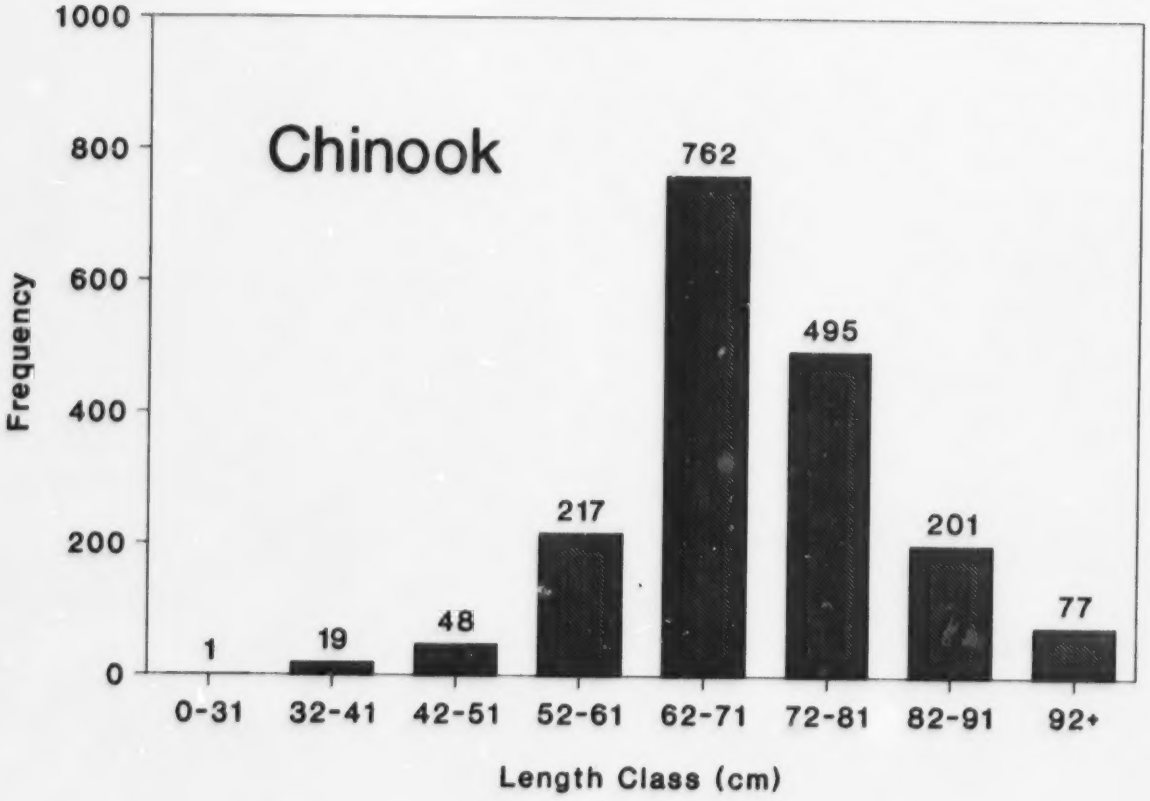

Figure 13. Length frequency distribution of chinook salmon sampled in the Strait of Georgia Creel Survey, 1990.

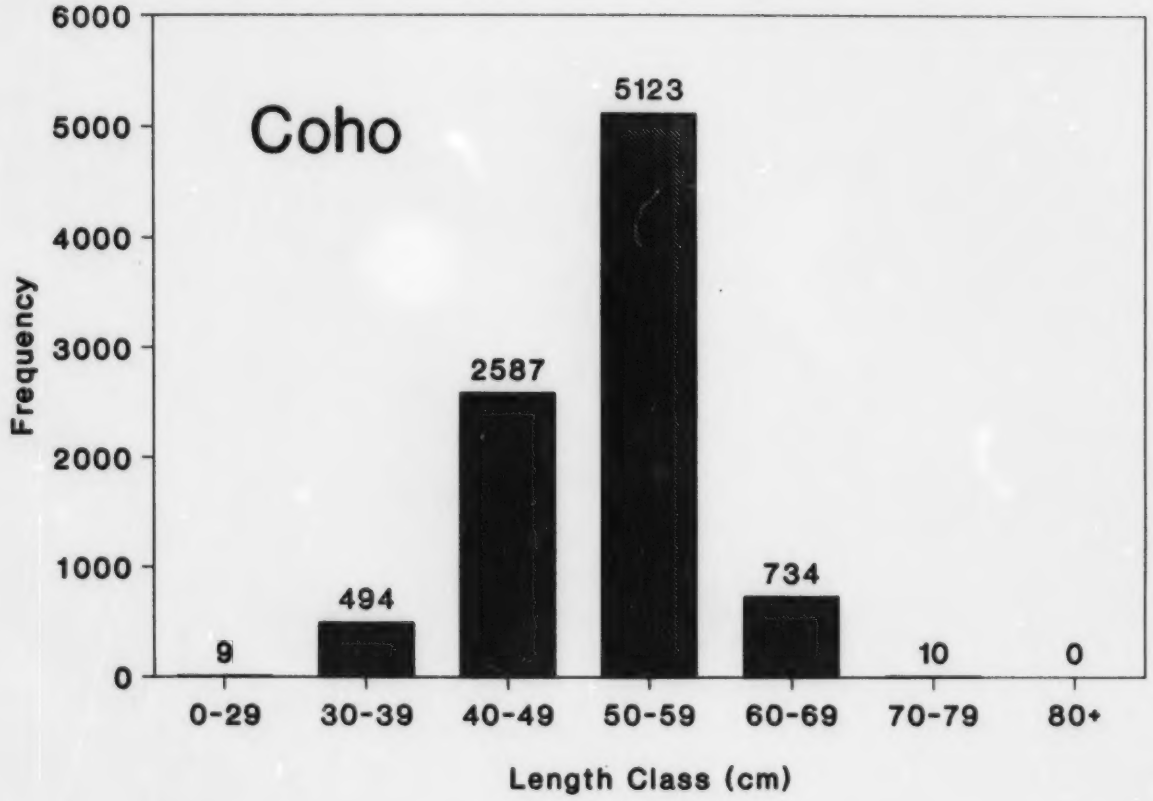

Figure 14. Length frequency distribution of coho salmon sampled in the Strait of Georgia Creel Survey, 1990.

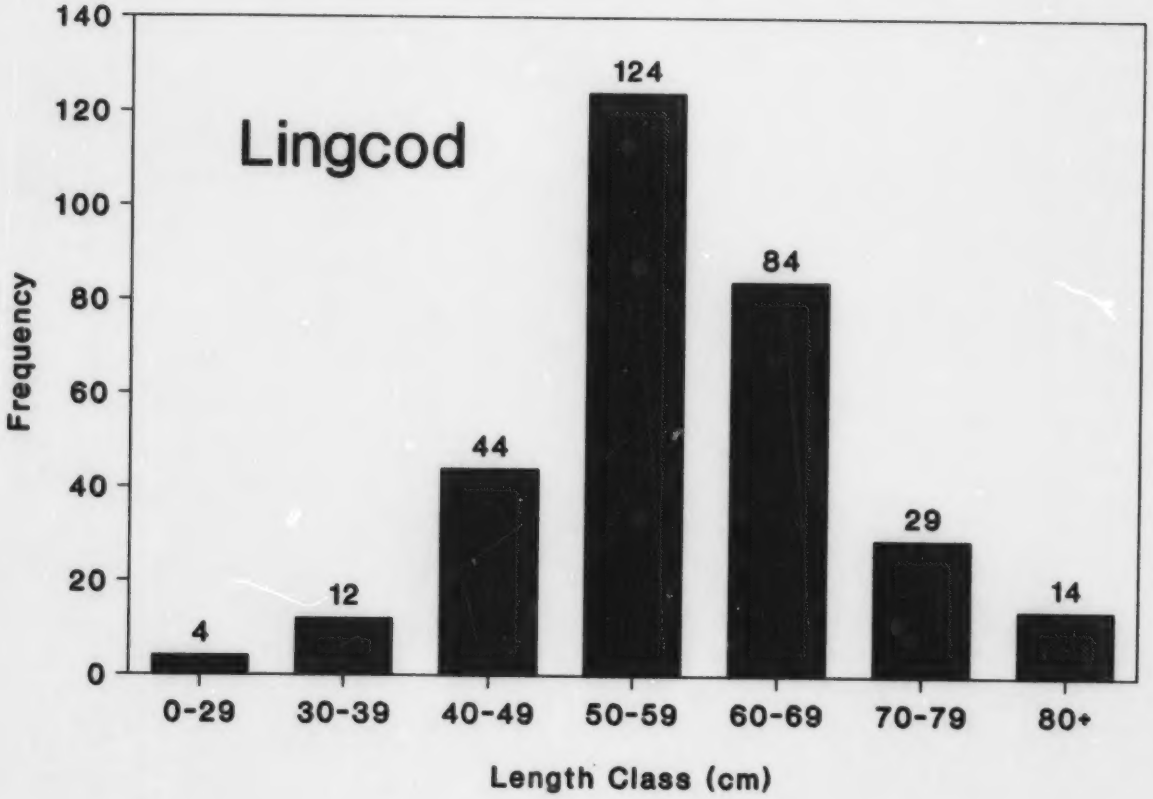

Figure 15. Length frequency distribution of lingcod sampled in the Strait of Georgia Creel Survey, 1990.

TABLES

Table 1. Tidal effort statistics and sport catches of coho and chinook salmon for the Strait of Georgia, 1960 -1990.*

Year	Effort (boat trips)	Catch	
		Coho	Chinook
1960	189,150	238,000	83,000
1961	199,935	152,000	63,000
1962	205,547	167,000	86,000
1963	247,590	199,000	65,000
1964	198,120	182,000	51,000
1965	250,020	175,000	53,000
1966	259,100	249,000	80,000
1967	254,500	200,000	115,000
1968	265,030	250,000	150,000
1969	281,475	200,000	185,000
1970	306,255	500,000	220,000
1971	341,123	800,000	255,000
1972	300,349	335,000	287,000
1973	293,141	373,000	272,000
1974	443,441	772,000	269,000
1975	334,490	454,000	398,000
1976	340,729	415,000	490,000
1977	363,350	682,000	372,000
1978	369,035	1,103,000	500,000
1979	404,710	708,735	350,000
1980	769,000	655,000	371,000
1981	637,000	391,200	253,300
1982	642,200	436,090	163,793
1983	574,257	404,031	198,433
1984	651,090	443,590	369,445
1985	628,513	728,197	234,838
1986	582,946	571,980	181,896
1987	589,731	641,572	121,081
1988	664,517	1,084,790	119,117
1989	603,331	497,223	132,846
1990	543,368	630,032	111,914

* SOURCE: Coho catch statistics: 1960–1978 from Argue et al. (1983), 1979 from R.Kadowaki (pers. comm.), 1980–1982 from unpublished creel survey data, 1983 from Shardlow et al. (1989), 1984 to 1988 from Shardlow and Collicutt (1989 a, b, c, d and e). 1989 from Collicutt and Shardlow (1990). Chinook catch statistics: 1960–1977 from Argue et al. (1983), 1978 and 1979 from B.Riddell (pers. comm.) following the methods of Argue et al. (1983), 1980–1982 from Shardlow et al. (Manuscr. 1989), 1983 from Shardlow et al. (1989), 1984 to 1988 from Shardlow and Collicutt (1989 a, b, c, d and e). 1990 from Collicutt and Shardlow (1990). Effort statistics: 1960–1979 from annual published and unpublished Fisheries Officer statistics, 1980–1982 from Shardlow et al. (Manuscr. 1989), 1983 from Shardlow et al. (1989), 1984 to 1988 from Shardlow and Collicutt (1989 a, b, c, d and e). 1989 from Collicutt and Shardlow (1990).

Table 2. Number of fishing interviews by month and Statistical Area, and number of overflights by month, Strait of Georgia, 1990.

Month	Statistical Area										Total	Over-flights
	13	14	15	16	17	18	19A	19B+	28	29		
Jan+Feb	24	32	0	211	78	39	25	410	67	27	913	4
Mar	15	150	0	256	134	24	11	377	45	51	1,063	4
Apr	50	316	0	212	348	31	29	295	148	35	1,464	4
May	176	429	108	385	901	22	80	331	268	46	2,746	7
Jun	607	1,206	151	615	626	34	79	908	159	110	4,495	10
Jul	880	965	159	555	636	80	158	1,041	281	124	4,879	11
Aug	1,168	907	108	544	598	88	39	1,169	269	638	5,528	10
Sep	264	369	51	394	487	52	28	874	183	466	3,168	8
Oct	17	41	0	25	77	43	4	148	18	5	378	6
Nov+Dec	6	21	0	80	43	15	9	242	26	12	454	4
Total	3,207	4,436	577	3,277	3,928	428	462	5,795	1,464	1,514	25,088	68

Table 3. Fishing effort and catch by species and month, Strait of Georgia, 1990.

Month		Effort No. Boat Trips	Coho	Chinook	Pink	Sockeye	Chum	Rock–Fish	Lingcod	Dog–Fish	Other Finfish	Total Finfish
Jan+Feb	Estimate	9,484	2,613	7,327	0	0	0	2,717	2 *	26	1,857	14,542
	S.E.	1,795	856	1,855	0	0	0	634	1	26	677	2,244
Mar	Estimate	12,615	6,794	5,207	0	7	0	2,556	72 *	163	1,049	15,848
	S.E.	1,239	1,238	819	0	8	0	682	64	130	331	1,673
Apr	Estimate	18,753	19,808	4,660	0	0	0	5,376	291 *	10	2,962	33,107
	S.E.	1,690	2,123	627	0	0	0	1,855	127	10	1,207	3,133
May	Estimate	60,243	74,093	14,838	0	18	20	15,984	7,662	155	2,837	115,607
	S.E.	4,191	8,045	1,466	0	21	22	1,493	1,311	57	895	8,463
Jun	Estimate	95,585	200,326	26,818	237	588	24	21,300	5,450	166	2,561	257,470
	S.E.	5,493	16,485	1,752	53	190	15	1,831	604	74	392	16,696
Jul	Estimate	129,811	158,751	21,958	1,991	1,076	0	40,469	9,378	584	7,383	241,590
	S.E.	4,525	7,834	1,234	295	198	0	2,832	933	117	817	8,520
Aug	Estimate	125,761	84,525	17,291	8,231	25,537	270	33,958	5,005	694	6,234	181,745
	S.E.	5,068	4,213	908	874	2,554	60	2,799	411	174	672	5,861
Sep	Estimate	67,397	64,849	5,203	1,090	3,387	338	25,710	3,306	650	2,645	107,178
	S.E.	2,776	4,301	472	309	336	101	2,315	421	146	334	4,961
Oct	Estimate	15,395	17,851	1,154	0	56	2,274	4,810	443	128	1,072	27,788
	S.E.	1,899	5,468	517	0	48	1,138	1,521	414	87	533	5,852
Nov+Dec	Estimate	8,324	422	7,458	0	0	52	1,978	107 *	103	1,416	11,536
	S.E.	1,799	236	2,512	0	0	43	659	63	113	1,521	3,022
Total	Estimate	543,368	630,032	111,914	11,549	30,669	2,978	154,858	31,716	2,679	30,016	1,006,411 **
	S.E.	10,773	21,698	4,344	974	2,591	1,145	5,818	1,870	335	2,609	23,301

* A total closure for lingcod was in effect from January 1 to April 30, and November 15 to December 31. Reported figures most likely represent illegal catches by anglers.

** In addition, an estimated 5,298 steelhead, cutthroat trout, and unidentified salmon were caught by sport fishermen.

Table 4. Fishing effort and catch by species and Statistical Area, Strait of Georgia, 1990.

Statistical Area		Effort No. Boat Trips	Coho	Chinook	Pink	Sockeye	Chum	Rock–Fish	Lingcod	Dog–Fish	Other Finfish	Total Finfish
13	Estimate	121,007	254,501	28,583	8,997	171	2,381	18,729	13,637	99	3,503	330,601
	S.E.	4,866	14,451	1,650	922	52	1,135	2,036	1,571	55	566	14,854
14	Estimate	129,744	191,986	18,062	1,927	59	3	23,769	4,763	542	3,022	244,133
	S.E.	6,292	14,029	1,546	278	31	4	2,133	605	144	426	14,297
15	Estimate	8,029	10,820	1,607	45	11	5	2,483	458	43	499	15,971
	S.E.	654	1,408	192	16	5	3	321	89	17	88	1,462
16	Estimate	43,292	35,797	10,305	269	16	0	43,179	5,016	414	2,705	97,701
	S.E.	1,870	2,539	847	125	7	0	3,075	579	168	365	4,139
17	Estimate	67,954	59,861	13,432	71	82	35	15,888	2,319	294	2,570	94,552
	S.E.	3,181	5,648	944	25	66	15	1,266	276	143	596	5,903
18	Estimate	20,962	1,070	3,657	0	423	150	8,013	1,002	187	994	15,496
	S.E.	1,084	289	473	0	142	83	910	195	95	216	1,121
19A	Estimate	20,536	1,059	2,798	0	0	0	8,232	431	37	1,576	14,133
	S.E.	3,778	490	657	0	0	0	2,481	212	32	869	2,762
19B+	Estimate	85,359	69,409	30,127	203	5,604	230	20,388	3,599	266	10,688	140,514
	S.E.	4,146	4,932	3,364	65	681	93	2,351	389	87	1,579	6,656
28	Estimate	16,369	1,641	1,449	5	4,666	82	6,351	146	32?	2,132	16,794
	S.E.	1,355	217	258	4	595	63	765	36	79	1,114	1,518
29	Estimate	30,116	3,888	1,894	32	19,637	92	7,826	345	475	2,327	36,516
	S.E.	2,069	395	274	17	2,422	50	946	80	126	1,129	2,880
Total	Estimate	543,368	630,032	111,914	11,549	30,669	2,978	154,858	31,716	2,679	30,016	1,006,411 *
	S.E.	10,773	21,698	4,344	974	2,591	1,145	5,818	1,870	335	2,609	23,301

* In addition, an estimated 5,298 steelhead, cutthroat trout and unidentified salmon were caught by sport fishermen.

Table 5. Monthly catch success (catch per boat trip) by species, Strait of Gerogia, 1990.*

Month	Chinook	Coho	Total ** Salmon	Rock–Fish	Lingcod	Total Non–Salmon	All Finfish
Jan+Feb	0.77	0.28	1.05	0.29	0.00	0.49	1.53
Mar	0.41	0.54	0.95	0.20	0.01	0.30	1.26
Apr	0.25	1.06	1.30	0.29	0.02	0.46	1.77
May	0.25	1.23	1.48	0.27	0.13	0.44	1.92
Jun	0.28	2.10	2.39	0.22	0.06	0.31	2.69
Jul	0.17	1.22	1.42	0.31	0.07	0.45	1.86
Aug	0.14	0.67	1.08	0.27	0.04	0.36	1.45
Sep	0.08	0.96	1.11	0.38	0.05	0.48	1.59
Oct	0.07	1.16	1.39	0.31	0.03	0.42	1.81
Nov+Dec	0.90	0.05	0.95	0.24	0.01	0.43	1.39
Total	0.21	1.16	1.45	0.28	0.06	0.40	1.85

* Calculated using Table 3 data.
** Includes coho, chinook, pink, chum and sockeye.

Table 6. Identification of rockfish by species in each Statistical Area, Strait of Georgia, 1990.

Species	Statistical Area										Total Sample
	13	14	15	16	17	18	19A	19B+	28	29	
Quillback (Sebastes maliger)	96	92	124	793	167	67	97	505	194	11	2,146
Copper (S. caurinus)	107	110	0	30	199	69	33	261	298	65	1,172
Yelloweye (S. ruberrimus)	14	42	14	91	23	0	2	15	0	0	201
Black (S. melanops)	4	1	0	9	0	0	1	126	7	0	148
Tiger (S. nigrocinctus)	0	0	4	4	10	0	1	6	1	0	26
Yellowtail (S. flavidus)	0	0	0	2	0	0	0	19	1	0	22
China (S. nebulosus)	0	0	0	0	0	0	0	34	2	0	36
Canary (S. pinniger)	2	8	1	33	3	1	1	32	15	0	96
Unidentified	219	169	25	870	146	141	59	527	359	63	2,578
Total sample	442	422	168	1,832	548	278	194	1,525	877	139	6,425

Table 7. Estimated catch of rockfish by species and Statistical Area, Strait of Georgia, 1990. +

Species		Statistical Area 13	14	15	16	17	18	19A	19B+	28	29	Total
Quillback	Catch	4,068	5,182	1,833	18,690	4,842	1,931	4,116	6,751	1,405	619	49,437
	S.D.	576	668	252	1,422	497	301	1,278	817	192	195	2,362
Copper	Catch	4,534	6,196	0	707	5,770	1,989	1,400	3,489	2,158	3,660	29,903
	S.D.	625	754	0	138	564	308	482	448	279	554	1,486
Yelloweye	Catch	593	2,366	207	2,145	667	0	85	201	0	0	6,264
	S.D.	170	407	60	268	147	0	67	57	0	0	547
Black	Catch	169	56	0	212	0	0	42	1,685	51	0	2,215
	S.D.	87	57	0	72	0	0	46	242	20	0	278
Other *	Catch	9,365	9,969	443	21,425	4,609	4,093	2,589	8,262	2,737	3,547	67,039
	S.D.	1,840	1,835	190	2,709	1,008	802	2,070	2,144	686	742	5,068
Total	Catch	18,729	23,769	2,483	43,179	15,888	8,013	8,232	20,388	6,351	7,826	154,858
	S.D.	2,036	2,133	321	3,075	1,266	910	2,481	2,351	765	946	5,818

+ Calculated using data from Table 6 and Appendix B–9.
* Other includes tiger, yellowtail, china, canary, and unidentified rockfish.

Table 8. Monthly number of marked chinook observed and total chinook inspected by region, Strait of Georgia, 1990.

Month		North Gulf	South Gulf	Victoria	Total Sample
Jan+Feb	Obs *	8	3	17	28
	Insp **	157	55	462	674
Mar	Obs	10	0	8	18
	Insp	138	46	290	474
Apr	Obs	5	6	7	18
	Insp	132	127	107	366
May	Obs	14	6	1	21
	Insp	320	161	84	565
Jun	Obs	41	12	7	60
	Insp	593	229	295	1,117
Jul	Obs	19	4	3	26
	Insp	414	215	143	772
Aug	Obs	23	3	12	38
	Insp	450	106	221	777
Sep	Obs	0	9	0	9
	Insp	91	66	56	213
Oct	Obs	0	0	1	1
	Insp	4	1	16	21
Nov+Dec	Obs	3	3	1	7
	Insp	21	15	328	364
Total	Obs	123	46	57	226
	Insp	2,320	1,021	2,002	5,343
Proportion of marks		0.053	0.045	0.028	0.042

* Obs – marks observed.
** Insp – fish inspected.

Table 9. Monthly number of marked coho observed and total coho inspected by region Strait of Georgia, 1990.

Month		North Gulf	South Gulf	Victoria	Total Sample
Jan+Feb	Obs *	3	2	9	14
	Insp **	71	27	200	298
Mar	Obs	27	3	2	32
	Insp	510	95	108	713
Apr	Obs	40	19	3	62
	Insp	1,084	622	140	1,846
May	Obs	26	101	0	127
	Insp	1,088	2,755	2	3,845
Jun	Obs	216	33	18	267
	Insp	7,075	840	389	8,304
Jul	Obs	132	12	55	199
	Insp	4,039	447	1,193	5,679
Aug	Obs	81	6	19	106
	Insp	3,063	226	330	3,619
Sep	Obs	43	8	16	67
	Insp	1,120	234	1,202	2,556
Oct	Obs	0	1	1	2
	Insp	28	15	246	289
Nov+Dec	Obs	0	1	0	1
	Insp	1	9	5	15
Total	Obs	568	186	123	877
	Insp	18,079	5,270	3,815	27,164
Proportion of marks		0.031	0.035	0.032	0.032

* Obs – marks observed.
** Insp – fish inspected.

Table 10. Monthly estimated catch of marked chinook by region, Strait of Georgia, 1990. *

Month		North Gulf	South Gulf	Victoria	Total Sample
Jan+Feb	Catch	66	48	190	304
	S.D.	38	33	80	95
Mar	Catch	71	0	95	166
	S.D.	33	0	39	51
Apr	Catch	45	85	109	239
	S.D.	21	36	55	69
May	Catch	420	143	17	580
	S.D.	125	61	18	140
Jun	Catch	1,149	303	105	1,557
	S.D.	197	93	45	222
Jul	Catch	634	105	52	791
	S.D.	150	54	31	162
Aug	Catch	564	89	169	822
	S.D.	120	54	51	141
Sep	Catch	0	144	0	144
	S.D.	0	51	0	51
Oct	Catch	0	0	34	34
	S.D.	0	0	37	37
Nov+Dec	Catch	16	50	22	88
	S.D.	13	45	24	53
Total	Catch	2,965	967	793	4,725
	S.D.	307	159	137	372

* Calculated using data from Table 8 and Appendix B–3.

Table 11. Monthly estimated catch of marked coho by region, Strait of Georgia, 1990. *

Month		North Gulf	South Gulf	Victoria	Total Sample
Jan+Feb	Catch	36	26	63	125
	S.D.	23	22	44	54
Mar	Catch	200	49	27	276
	S.D.	66	31	23	76
Apr	Catch	351	235	56	642
	S.D.	75	66	41	108
May	Catch	1,091	1,042	0	2,133
	S.D.	258	218	0	338
Jun	Catch	5,566	409	352	6,327
	S.D.	624	83	121	641
Jul	Catch	4,150	256	1,024	5,430
	S.D.	429	80	179	472
Aug	Catch	1,958	140	301	2,399
	S.D.	241	59	81	261
Sep	Catch	1,594	124	262	1,980
	S.D.	281	45	70	293
Oct	Catch	0	38	36	74
	S.D.	0	41	39	57
Nov+Dec	Catch	0	8	0	8
	S.D.	0	9	0	9
Total	Catch	14,946	2,327	2,121	19,394
	S.D.	887	272	253	962

* Calculated using data from Table 9 and Appendix B–2.

Table 12. Monthly number and percent age composition of chinook sampled for age in the Strait of Georgia Creel Survey, 1990 (n gives sample size).

Month	Age 2		Age 3		Age 4		Age 5+		Total Sample
	n	%	n	%	n	%	n	%	
Jan+Feb	1	0.6%	36	21.4%	126	75.0%	5	3.0%	168
Mar	4	2.9%	38	27.3%	95	68.3%	2	1.4%	139
Apr	1	0.8%	35	29.4%	82	68.9%	1	0.8%	119
May	13	4.3%	100	33.2%	179	59.5%	9	3.0%	301
Jun	0	0.0%	11	34.4%	21	65.6%	0	0.0%	32
Jul	19	5.5%	130	37.5%	184	53.0%	14	4.0%	347
Aug	19	7.1%	115	42.9%	122	45.5%	12	4.5%	268
Sep	14	19.2%	43	58.9%	16	21.9%	0	0.0%	73
Oct	1	– **	3	– **	1	– **	0	– **	5
Nov+Dec	20	51.3%	15	38.5%	4	10.3%	0	0.0%	39
Total	92	–	526	–	830	–	43	–	1,491
Overall age composition of catch *	–	7.5%	–	36.4%	–	53.9%	–	2.2%	–

* Overall age composition of estimated catch based on data from Table 13.
** Percent age composition was not calculated for months with total sample size of less than 10.

Table 13. Monthly estimated catch at age of chinook in the Strait of Georgia, 1990. *

Month		Age 2	Age 3	Age 4	Age 5+	Total **
Jan+Feb	Catch	44	1,570	5,495	218	7,327
	S.D.	46	464	1,414	113	1,855 ++
Mar	Catch	150	1,423	3,559	75	5,207
	S.D.	78	300	597	55	819 ++
Apr	Catch	39	1,371	3,211	39	4,660
	S.D.	40	269	476	40	627 ++
May	Catch	641	4,930	8,824	444	14,839
	S.D.	186	633	969	153	1,466 ++
Jun	Catch	0	9,219	17,599	0	26,818
	S.D.	0	2,335	2,533	0	1,752 ++
Jul	Catch	1,202	8,226	11,644	886	21,958
	S.D.	277	735	881	238	1,234 ++
Aug	Catch	1,226	7,420	7,871	774	17,291
	S.D.	279	653	670	222	908 ++
Sep	Catch	998	3,065	1,140	0	5,203
	S.D.	257	410	273	0	472 ++
Oct	Catch	231	692	231	0	1,154
	S.D.	249	416	249	0	517 ++
Nov+Dec	Catch	3,825	2,868	765	0	7,458
	S.D.	1,434	1,144	461	0	2,512 ++
Total	Catch	8,356	40,784	60,339	2,436	111,915
	S.D.	1,544	2,974	3,393	383	4,344 ++
Overall age composition		7.5%	36.4%	53.9%	2.2%	100.0%

* Calculated by applying to the total monthly chinook catch the monthly age proportions from Table 12.

** Monthly total catch and S.E. from Table 3.

++ S.E.

Table 14. Monthly mean nose–fork length (L) at age of chinook sampled in the Strait of Georgia Creel Survey, 1990. (n gives sample size).

Month	Age 2		Age 3		Age 4		Age 5		Age 6		Total Sample
	L (cm)	n	L (cm)	n	L (cm)	n	L (cm)	n	L (cm)	n	
Jan+Feb	46.5	1	57.8	36	64.2	126	59.1	5	–	0	168
Mar	36.0	4	58.8	38	67.5	95	88.5	2	–	0	139
Apr	38.0	1	62.4	35	71.2	82	77.0	1	–	0	119
May	57.2	13	64.2	100	72.8	179	84.1	9	–	0	301
Jun	–	0	67.4	11	75.6	21	–	0	–	0	32
Jul	60.5	19	68.8	130	79.9	184	92.6	14	–	0	347
Aug	59.0	19	69.7	115	82.4	122	99.6	12	–	0	268
Sep	59.9	14	65.9	43	78.2	16	–	0	–	0	73
Oct	50.0	1	69.7	3	76.0	1	–	0	–	0	5
Nov+Dec	55.6	20	65.7	15	70.0	4	–	0	–	0	39
Total	57.0	92	65.8	526	73.9	830	88.3	43	–	0	1,491

APPENDICES

APPENDIX A

METHODS AND EQUATIONS USED IN ANALYSIS OF CATCH AND EFFORT STATISTICS FOR THE STRAIT OF GEORGIA SPORT FISHERY CREEL SURVEYS, 1983-1990[1]

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[1] Adapted from:

Shardlow, T. F., K. K. English, T. Hoyt, G. E. Gillespie and T. A. Calvin. 1989. Strait of Georgia Creel Survey sport fishery statistics, 1983. Can. MS Rep. Fish. Aquat. Sci. 1872:52 p.

APPENDIX A. METHODS AND EQUATIONS USED IN ANALYSIS OF CATCH AND EFFORT STATISTICS FOR THE STRAIT OF GEORGIA SPORT FISHERY CREEL SURVEYS, 1983-1990.

The description of terms, variables and subscripts used in the data analysis is given in Table A-1.

Calculation of Catch and Effort Statistics

To estimate the monthly catch and effort, three components had to be calculated from that month's data:

(1) the weighted mean daily fishing pattern from interview data,
(2) the weighted mean catch per unit effort from interview data and
(3) the mean sport count from overflight data.

The equations used to estimate the means and variances for all catch and effort statistics are shown below.

Weighting factors used to estimate the daily fishing activity pattern and mean catch per unit effort were calculated using the equations derived from DPA Consulting Ltd. (1982).

The data obtained from each shift were multiplied by the following weighting factor (W1) to expand for all possible stints at each site. The formula reads:

$$W1_{dij} = \frac{N_d}{n_{dij}} \qquad (1)$$

where N_d is the total number of days of type d in that month and n_{dij} is the number of times the jth work block at the ith site was sampled on type d days.

The interviews aggregated by work block were multiplied by the weighting factor W2 to expand for all boats that landed in each work block. The formula reads:

$$W2_{dijk} = \frac{L_{dijk}}{I_{dijk}} \qquad (2)$$

Table A-1. Description of terms, variables and subscripts used in this report.

DESCRIPTION OF TERMS

Shift/Stint – Represents a combination of a day type and landing site which was sampled on a single day. i.e. one sampling stint performed by an interviewer.

Work block – Represents one of four possible periods at a particular site of a given day type.
Work Block 1 is before 11 am
Work Block 2 is 11 am - 3 pm
Work Block 3 is 3 pm - 7 pm
Work Block 4 is after 7 pm

Day type – There are two possible day types: weekdays and weekends; holidays are considered to be weekend days.

Time block – Each day is divided into 16 time blocks which are:
1) before 7 am
2) 7:00 - 7:59 am
3) 8:00 - 8:59 am
.
.
.
15) 8:00 - 8:59 pm
16) after 9 pm

DESCRIPTION OF VARIABLES

A	–	Number of boats actively fishing
B	–	Number of boats observed on a flight
C	–	Catch
C	–	Catch of marked salmon
CPE	–	Catch per boat trip
E	–	Effort (estimated total number of boat trips)
I	–	Number of boats interviewed and found to have been fishing
L	–	Number of boats landing
n	–	Number sampled
N	–	Population size from which n samples were observed
P	–	Proportion
T	–	Number of boat trips
V	–	Number found to be marked
W1	–	Weighting factor to expand for all possible stints at each site
W2	–	Weighting factor to expand for all boats that landed in each work

DESCRIPTION OF SUBSCRIPTS

a	–	age
g	–	a set of landing sites
d	–	day type
i	–	site
j	–	work block
k	–	stint
l	–	landing time block
m	–	month
q	–	the next boat landing at site i and upon interviewing, found to have been fishing (q ranges from 1 to n)
r	–	species
s	–	sub-Statistical Area
t	–	time block
u	–	flight
x	–	region
y	–	annual

where L_{dijk} is the number of boats landed and I_{dijk} is the number of boats interviewed on the kth stint in the jth work block at the ith site on a day type d.

Therefore, the following equations can be used to calculate an unbiased estimate of the total monthly catch ($\hat{C}_{dgr}$), fishing trips ($\hat{T}_{dg}$) and fishing activity in time block $\hat{A}_{dgt}$ for each day type (d) where g is a set of landing sites (i). These formulas read:

$$\hat{C}_{dgr}=\sum_i \sum_j \left[W1_{dij} \sum_k \sum_q \left(W2_{dijk} C_{dijkqr} \right) \right] \quad (3)$$

$$\hat{T}_{dg}=\sum_i \sum_j \left[W1_{dij} \sum_k \sum_q \left(W2_{dijk} \right) \right] \quad (4)$$

$$\hat{A}_{dgt}=\sum_i \sum_j \left[W1_{dij} \sum_k \sum_q \left(W2_{dijk} A_{dijkqt} \right) \right] \quad (5)$$

where C_{dijkqr} is the catch of species r by the qth fishing party, and A_{dijkqt} can equal 0 or 1, thereby indicating whether the qth fishing party was actively fishing in time block t. Thus, the mean monthly catch per unit effort (CPE_{dgr}) measured in terms of numbers of fish kept per completed boat trip, and proportion of daily fishing effort active during the hour of the aerial survey (P_{dgt}) can be calculated with the following equations:

$$CPE_{dgr}=\frac{\hat{C}_{dgr}}{\hat{T}_{dg}} \quad (6)$$

$$P_{dgt}=\frac{\hat{A}_{dgt}}{\hat{T}_{dg}} \quad (7)$$

where CPE_{dgr} and P_{dgt} are calculated for each day type (d) and group of landing sites (g).

The groups of landing sites reflect geographic areas with similar catch rates and/or activity patterns.

The estimated mean number of boats fishing during the hour of the sport boat count by overflight was calculated for each sub-Statistical Area using the following equation:

$$\overline{B}_{dst} = \frac{\sum_{u} B_{dstu}}{n_{ds}} \qquad (8)$$

where B_{dstu} is the number of boats observed fishing on flight u at time t, in sub-Statistical Area s for day type d.

The mean sport boat count at the time of the overflight ($\overline{B}_{dst}$) and proportion of daily fishing effort active during the hour of the overflight (P_{dgt}) were used in the following equation to calculate the total fishing effort for sub-Statistical Area s on day type d:

$$E_{ds} = \overline{B}_{dst} \frac{1}{P_{dgt}} N_d \qquad (9)$$

where N_d is the number of type d days in the month. Interview data for the sub-Statistical Areas fished (s) by anglers landing at each of the sites (i) within a landing group (g) were used to select the proportions (P_{dgt}) that are appropriate for each mean boat count ($\overline{B}_{dst}$).

The estimate for total effort by sub-Statistical Area and day type (E_{ds}) and the weighted catch per boat trip for a group of landing sites by day type, area and species (CPE_{dgr}) were used to calculate total catch for each species (r) and each sub-Statistical Area (s):

$$C_{sr} = \sum_{d} (E_{ds} CPE_{dgr}) \qquad (10)$$

The interview data were also used to select the catch per effort estimates (CPE_{dgt}) that should be applied to the effort estimates (E_{ds}) for a specific sub-Statistical Area (s).

Variance of Total Fishing Effort

The variance for estimates of total fishing effort has two components:

(1) the variance in aerial sport boat counts:

$$S^2_{B_{dst}} = \frac{\sum_u B^2_{dstu} - \frac{\left(\sum_u B_{dstu}\right)^2}{n_{ds}}}{n_{ds}(n_{ds}-1)} \left[\frac{N_d - N_{ds}}{N_d - 1}\right] \qquad (11)$$

where B_{dstu} is the aerial sport boat count at time t during an aerial survey u on a type d day in sub-area s; n_{ds} is the number of aerial surveys in which boats were counted on type d days, in sub-Statistical Area s; and N_d is the total number of type d days in the months.

(2) the variance in the proportion of boats fishing during the hours of the aerial boat counts:

$$S^2_{P_{dgt}} = \frac{P_{dgt}(1-P_{dgt})}{I_{dg}} \qquad (12)$$

where P_{dgt} is the mean proportion of boats fishing for a group of landing sites g during the hour of the aerial boat count t on type d days, and I_{dg} is the total number of sport fishing boats interviewed. The above formula assumes P_{dgt} is unbiased and normally distributed where the number of interviews is large.

The variances for boat counts ($S^2_{B_{dst}}$) and proportion of boats fishing ($S^2_{P_{dgt}}$) were combined in the following equation to calculate variance for effort:

$$S^2_{E_{ds}} = N^2_d \left(\frac{B^2_{dst}}{P^2_{dgt}} \right) \left(\frac{S^2_{B_{dst}}}{B^2_{dst}} + \frac{S^2_{P_{dgt}}}{P^2_{dgt}} \right) \qquad (13)$$

where $S^2_{E_{ds}}$ is the variance for total effort on type d days in sub-area s, and the formula is the standard formula for the variance of a ratio of two independent random variables.

Variance of Total Catch

The variance for estimates of total catch had two components: (1) the variance for total effort (presented above), and (2) the variance for catch per boat trip.

The variance for catch per boat trip ($S^2_{CPE_{dgr}}$) was calculated using the following equation:

$$S^2_{CPE_{dgr}} = \frac{SS_{CPE_{dgr}} - \frac{(S_{CPE_{dgr}})^2}{I_{dg}}}{I_{dg}(I_{dg}-1)} \qquad (14)$$

where $SS_{CPE_{dgr}}$ is the weighted sum of squares for CPE_{dgr}, and $S_{CPE_{dgr}}$ is the weighted sum for CPE_{dgr}, such that the sum of the weighting factors used to estimate CPE_{dgr} was equal to the number of interviewed boat trips (I_{dg}).

The variance for total effort and the variance in the catch per boat trip for the appropriately grouped landing sites were combined in the following equation to calculate variance for total catch:

$$S^2_{C_{sr}} = \sum_d \left(E^2_{ds} S^2_{CPE_{dgr}} + CPE^2_{dgr} S^2_{E_{ds}} + S^2_{CPE_{dgr}} S^2_{E_{ds}} \right) \qquad (15)$$

which is the standard formula for the variance of the product of two independent random variables, and where $S^2_{C_{sr}}$ is the variance for total number of species r in sub-Statistical Area s.

Estimation of Marked Chinook and Coho Salmon

The incidence of marked (adipose-clipped) chinook and coho was recorded in each interview. The proportion of marks observed for each region, month and species (P_{xmr}) was calculated as:

$$P_{xmr} = \frac{V_{xmr}}{n_{xmr}} \qquad (16)$$

where V is the number of marked fish observed and n is the number of fish inspected by region (x), month (m) and species (r).

The variance of each proportion was calculated as:

$$S^2_{P_{xmr}} = \frac{P_{xmr}(1-P_{xmr})}{n_{xmr}} \qquad (17)$$

Monthly catch estimates of marked salmon were calculated as:

$$\acute{C}_{xmr} = P_{xmr} C_{xmr} \qquad (18)$$

where C_{xmr} is the estimated catch of species r in region x and month m.

The variance of the marked catch estimates was calculated as:

$$S^2_{\acute{C}_{xmr}} = P^2_{xmr} S^2_{C_{xmr}} + C^2_{xmr} S^2_{P_{xmr}} + S^2_{C_{xmr}} S^2_{P_{xmr}} \qquad (19)$$

where $S^2_{C_{xmr}}$ is the variance of the catch estimates of species r in region x and month m.

The estimate annual proportions of marked salmon caught in each region (weighted by the corresponding regional annual catch estimates) were calculated as:

$$P_{xry} = \frac{\acute{C}_{xry}}{C_{xry}} \qquad (20)$$

where

$$\acute{C}_{xry} = \sum_m \acute{C}_{xmr} \quad \text{and} \quad C_{xry} = \sum_m C_{xmr} \qquad (21)$$

The variance of the annual proportions was calculated as:

$$S^2_{P_{xry}} = \left(\frac{\acute{C}_{xry}}{C_{xry}}\right)^2 \left[\frac{S^2_{\acute{C}_{xry}}}{(\acute{C}_{xry})^2} + \frac{S^2_{C_{xry}}}{(C_{xry})^2}\right] \qquad (22)$$

where $S^2_{C_{xry}}$ is the variance of the annual estimated catch of species r in region x.

Estimation of Age Composition of Chinook Catch

Scale samples and length measurements were taken in a sub-sampling program during the interview process. Ages used in this report represent total age of the fish (including both freshwater and oceanic life) according to the Gilbert-Rich (1927) recording convention.

The proportion of chinook at each age and month (P_{am}) was calculated as:

$$P_{am}=\frac{a_m}{n_m} \quad (23)$$

where a_m represents the number of fish observed at age a during month m, and n_m is the total number of fish bio-sampled in that month.

The variance of each proportion was calculated as:

$$S^2_{am}=\frac{P_{am}(1-P_{am})}{n_m} \quad (24)$$

The catch at age of chinook in each month was calculated as:

$$C_{am}=P_{am}C_m \quad (25)$$

where C_m is the estimated catch of chinook salmon in a given month m.

The variance of the catch at age estimate was calculated as:

$$S^2_{C_{am}}=P^2_{am}S^2_{C_m} + C^2_m S^2_{P_{am}} + S^2_{C_m}S^2_{P_{am}} \quad (26)$$

where $S^2_{C_m}$ is the variance of the month catch estimate C_m.

The annual catch at age was calculated as:

$$C_{ay}=\sum_m C_{am} \quad (27)$$

with a variance:

$$S^2_{C_{ay}} = \sum_{m} S^2_{C_{am}} \qquad (28)$$

The annual proportion at age (weighted by monthly catch) was calculated as:

$$P_{ay} = \frac{C_{ay}}{C_y} \qquad (29)$$

with a variance:

$$S^2_{P_{ay}} = \left(\frac{C_{ay}}{C_y}\right)^2 \left[\frac{S^2_{C_{ay}}}{(C_{ay})^2} + \frac{S^2_{C_y}}{(C_y)^2}\right] \qquad (30)$$

APPENDIX B

CATCH AND EFFORT STATISTICS BY MONTH AND STATISTICAL AREA FOR THE STRAIT OF GEORGIA, 1990.

APPENDIX B–1. STRAIT OF GEORGIA FISHING EFFORT (NO. BOAT TRIPS), 1990.

Month		Statistical Area										
		13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Estimate	764	399	22	1,064	992	427	241	3,854	1,172	549	9,484
	S.E.	426	71	21	457	331	243	47	1,433	724	279	1,795
March	Estimate	804	1,363	117	1,823	2,168	646	200	4,171	936	387	12,615
	S.E.	272	306	36	394	577	154	56	848	325	161	1,239
April	Estimate	1,154	2,058	242	1,780	4,619	589	525	5,376	1,894	516	18,753
	S.E.	139	386	102	338	598	200	41	1,286	692	181	1,690
May	Estimate	13,437	16,338	1,052	6,035	12,926	1,585	1,748	4,353	749	2,020	60,243
	S.E.	1,909	2,910	272	888	1,785	217	523	799	168	644	4,191
June	Estimate	22,737	31,170	1,568	8,055	11,748	1,740	2,127	12,231	1,646	2,563	95,585
	S.E.	2,501	4,159	376	711	974	298	849	1,965	277	532	5,493
July	Estimate	35,084	32,756	2,575	9,574	14,770	6,008	4,777	17,079	3,725	3,463	129,811
	S.E.	2,369	2,578	387	917	1,913	555	885	1,306	515	713	4,525
August	Estimate	30,393	29,436	1,353	8,085	12,254	5,766	7,502	16,272	2,790	11,910	125,761
	S.E.	1,789	2,214	166	636	948	614	3,419	1,309	360	1,530	5,068
September	Estimate	12,842	14,327	974	5,681	6,503	2,401	2,444	12,163	2,525	7,537	67,397
	S.E.	1,729	1,358	146	638	647	263	855	867	276	629	2,776
October	Estimate	3,661	1,484	90	621	1,822	1,323	685	4,792	398	519	15,395
	S.E.	1,303	386	40	163	454	167	199	1,170	135	266	1,899
Nov+Dec	Estimate	131	413	36	574	152	477	287	5,068	534	652	8,324
	S.E.	54	177	24	218	57	366	160	1,652	363	363	1,799
Total	Estimate	121,007	129,744	8,029	43,292	67,954	20,962	20,536	85,359	16,369	30,116	543,368
	S.E.	4,866	6,292	654	1,871	3,131	1,084	3,778	4,147	1,354	2,069	10,773

APPENDIX B–2. STRAIT OF GEORGIA COHO CATCH SUMMARY, 1990.

Month		Statistical Area										
		13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Catch	30	713	0	118	349	0	3	1,400	0	0	2,613
	S.E.	35	211	0	95	136	0	4	812	0	0	856
March	Catch	0	3,215	37	527	1,489	0	0	1,466	30	30	6,794
	S.E.	0	990	11	222	373	0	0	603	30	17	1,238
April	Catch	2,227	4,683	39	2,551	7,581	25	16	2,599	55	32	19,808
	S.E.	514	1,142	23	604	1,227	21	13	1,032	49	15	2,123
May	Catch	13,791	28,820	254	2,781	28,152	129	0	25	25	116	74,093
	S.E.	2,348	5,594	100	680	5,237	80	0	18	11	54	8,045
June	Catch	81,020	89,906	4,813	6,581	9,626	140	261	7,602	110	267	200,326
	S.E.	10,853	12,104	1,244	986	1,121	86	204	1,901	57	128	16,485
July	Catch	79,985	33,695	3,287	10,032	7,515	84	165	22,212	810	966	158,751
	S.E.	6,378	3,130	574	1,666	1,153	49	63	2,525	180	216	7,834
August	Catch	44,789	19,625	1,696	7,918	2,610	403	393	5,231	316	1,544	84,525
	S.E.	3,259	2,273	280	944	347	244	400	765	63	254	4,213
September	Catch	24,366	11,186	694	5,262	2,242	75	96	19,700	295	933	64,849
	S.E.	3,493	1,312	127	961	306	37	70	1,872	72	163	4,301
October	Catch	8,293	143	0	27	250	204	114	8,820	0	0	17,851
	S.E.	4,664	65	0	19	80	76	171	2,846	0	0	5,468
Nov+Dec	Catch	0	0	0	0	47	10	11	354	0	0	422
	S.E.	0	0	0	0	28	11	17	233	0	0	236
Total	Catch	254,501	191,986	10,820	35,797	59,861	1,070	1,059	69,409	1,641	3,888	630,032
	S.E.	14,451	14,029	1,408	2,539	5,648	289	490	4,932	220	397	21,698

APPENDIX B–3. STRAIT OF GEORGIA CHINOOK CATCH SUMMARY, 1990.

Month		Statistical Area										
		13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Catch	736	38	25	495	287	237	34	5,158	205	112	7,327
	S.E.	495	20	25	286	102	232	21	1,737	160	89	1,856
March	Catch	252	267	48	406	363	170	23	3,429	171	78	5,207
	S.E.	297	109	13	97	105	66	32	735	60	31	819
April	Catch	256	462	110	363	1,275	65	96	1,663	296	74	4,660
	S.E.	74	118	54	129	189	39	54	536	162	26	627
May	Catch	2,537	4,261	563	2,230	2,473	308	294	1,414	205	553	14,838
	S.E.	541	1,130	149	432	417	85	145	362	50	188	1,466
June	Catch	7,102	5,705	306	3,509	4,255	262	447	4,414	299	519	26,818
	S.E.	844	863	75	558	616	111	288	892	71	142	1,752
July	Catch	8,922	2,851	262	1,782	2,739	1,265	1,296	2,490	178	173	21,958
	S.E.	880	380	62	280	477	245	366	309	54	39	1,234
August	Catch	6,355	3,376	187	1,115	1,282	1,170	393	3,111	52	250	17,291
	S.E.	513	386	33	156	187	286	400	324	18	70	908
September	Catch	1,856	1,076	96	304	746	115	88	815	26	81	5,203
	S.E.	348	221	21	78	134	42	86	135	10	24	472
October	Catch	567	26	0	0	0	25	0	536	0	0	1,154
	S.E.	470	17	0	0	0	19	0	215	0	0	517
Nov+Dec	Catch	0	0	10	101	12	40	127	7,097	17	54	7,458
	S.E.	0	0	7	61	6	31	148	2,506	20	58	2,512
Total	Catch	28,583	18,062	1,607	10,305	13,432	3,657	2,798	30,127	1,449	1,894	111,914
	S.E.	1,650	1,546	192	848	944	473	657	3,364	258	275	4,344

APPENDIX B–4. STRAIT OF GEORGIA PINK CATCH SUMMARY, 1990.

Month		Statistical Area										
		13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
March	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
April	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
May	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
June	Catch	29	169	27	5	0	0	0	7	0	0	237
	S.E.	20	47	13	4	0	0	0	8	0	0	53
July	Catch	1,277	383	7	218	14	0	0	87	0	5	1,991
	S.E.	245	98	6	123	12	0	0	44	0	5	295
August	Catch	6,999	1,004	11	46	44	0	0	95	5	27	8,231
	S.E.	847	209	7	23	21	0	0	46	4	16	874
September	Catch	692	371	0	0	13	0	0	14	0	0	1,090
	S.E.	271	147	0	0	7	0	0	13	0	0	309
October	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
Nov+Dec	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
Total	Catch	8,997	1,927	45	269	71	0	0	203	5	32	11,549
	S.E.	923	278	16	125	25	0	0	65	4	17	974

APPENDIX B–5. STRAIT OF GEORGIA SOCKEYE CATCH SUMMARY, 1990.

Month		Statistical Area										
		13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
March	Catch	0	7	0	0	0	0	0	0	0	0	7
	S.E.	0	8	0	0	0	0	0	0	0	0	8
April	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
May	Catch	0	14	4	0	0	0	0	0	0	0	18
	S.E.	0	21	3	0	0	0	0	0	0	0	21
June	Catch	0	16	2	4	80	0	0	486	0	0	588
	S.E.	0	18	2	4	66	0	0	177	0	0	190
July	Catch	61	14	2	3	2	0	0	721	128	145	1,076
	S.E.	38	8	2	2	3	0	0	146	84	97	198
August	Catch	110	3	1	4	0	417	0	4,190	3,752	17,060	25,537
	S.E.	35	4	1	4	0	142	0	638	574	2,401	2,554
September	Catch	0	5	2	5	0	0	0	207	758	2,410	3,387
	S.E.	0	7	2	4	0	0	0	60	126	305	336
October	Catch	0	0	0	0	0	6	0	0	28	22	56
	S.E.	0	0	0	0	0	8	0	0	40	25	48
Nov+Dec	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
Total	Catch	171	59	11	16	82	423	0	5,604	4,666	19,637	30,669
	S.E.	52	31	5	7	66	142	0	681	595	2,422	2,591

APPENDIX B–6. STRAIT OF GEORGIA CHUM CATCH SUMMARY, 1990.

Month		Statistical Area										
		13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
March	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
April	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
May	Catch	0	0	0	0	0	0	0	0	7	13	20
	S.E.	0	0	0	0	0	0	0	0	8	21	22
June	Catch	0	0	0	0	0	0	0	24	0	0	24
	S.E.	0	0	0	0	0	0	0	15	0	0	15
July	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
August	Catch	173	3	5	0	27	0	0	30	5	27	270
	S.E.	49	4	3	0	13	0	0	24	5	20	60
September	Catch	335	0	0	0	0	0	0	0	1	2	338
	S.E.	101	0	0	0	0	0	0	0	1	2	101
October	Catch	1,873	0	0	0	8	145	0	129	69	50	2,274
	S.E.	1,130	0	0	0	7	83	0	78	62	41	1,138
Nov+Dec	Catch	0	0	0	0	0	5	0	47	0	0	52
	S.E.	0	0	0	0	0	6	0	42	0	0	42
Total	Catch	2,381	3	5	0	35	150	0	230	82	92	2,978
	S.E.	1,136	4	3	0	15	83	0	93	63	50	1,145

APPENDIX B–7. STRAIT OF GEORGIA CATCH SUMMARY FOR TOTAL SALMONIDS, 1990. *

Month		Statistical Area										
		13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Catch	761	752	17	670	633	237	37	6,558	205	112	9,982
	S.E.	505	215	17	407	221	232	23	2,449	160	89	2,569
March	Catch	252	3,489	88	940	1,853	170	23	4,896	189	87	11,987
	S.E.	297	1,088	21	263	455	66	32	1,193	63	34	1,727
April	Catch	2,482	5,144	150	2,913	8,855	90	112	4,262	352	107	24,467
	S.E.	527	1,216	72	626	1,357	50	55	1,359	182	33	2,425
May	Catch	16,332	33,099	822	5,010	30,658	437	294	1,438	239	692	89,021
	S.E.	2,612	5,947	229	965	5,360	120	145	364	56	223	8,493
June	Catch	88,149	95,844	5,151	10,099	13,980	402	708	12,534	410	788	228,065
	S.E.	11,180	12,742	1,318	1,293	1,468	141	446	2,795	103	220	17,349
July	Catch	90,326	37,147	3,562	12,043	10,428	1,367	1,462	25,550	1,231	1,493	184,609
	S.E.	6,994	3,387	615	1,800	1,530	252	377	2,747	256	344	8,619
August	Catch	58,429	24,051	1,907	9,119	3,993	2,206	785	12,704	4,296	19,632	137,122
	S.E.	3,908	2,532	305	1,031	486	448	723	1,433	646	2,718	5,802
September	Catch	27,247	12,781	793	5,579	3,040	222	226	20,740	1,714	5,425	77,767
	S.E.	3,918	1,440	136	984	403	61	156	1,938	231	540	4,765
October	Catch	10,730	231	3	27	344	377	114	9,485	98	72	21,481
	S.E.	5,652	85	2	19	100	114	171	2,994	76	52	6,401
Nov+Dec	Catch	0	0	12	101	61	55	138	7,501	17	54	7,939
	S.E.	0	0	7	61	33	38	150	2,669	20	58	2,675
Total	Catch	294,708	212,538	12,505	46,501	73,845	5,563	3,899	105,668	8,751	28,462	792,440
	S.E.	15,618	14,846	1,512	2,916	5,978	614	983	6,830	787	2,813	23,820

* Includes coho, chinook, pink, chum, sockeye, steelhead and cutthroat trout.

APPENDIX B–8. STRAIT OF GEORGIA SUMMARY FOR RELEASED SALMON, 1990.

Month		Statistical Area										
		13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Catch	1,384	326	98	2,063	872	479	619	5,530	310	41	11,722
	S.E.	850	98	95	1,291	297	304	293	2,082	199	37	2,655
March	Catch	731	1,647	212	1,810	1,281	100	39	2,383	178	106	8,487
	S.E.	608	439	83	495	368	33	42	643	65	66	1,172
April	Catch	1,093	2,505	200	1,166	3,289	125	288	1,576	705	147	11,094
	S.E.	306	675	67	379	525	67	106	430	432	69	1,168
May	Catch	5,745	9,625	714	1,199	6,021	178	1,974	350	326	869	27,001
	S.E.	975	2,037	212	247	946	51	809	114	83	314	2,622
June	Catch	10,372	17,366	1,085	2,615	11,101	557	1,231	3,752	627	1,125	49,831
	S.E.	1,243	2,226	300	369	1,302	203	725	937	195	403	3,173
July	Catch	51,576	55,825	1,603	8,016	19,094	1,476	2,239	20,422	3,211	3,701	167,163
	S.E.	4,976	5,141	307	1,223	3,125	284	774	2,901	793	1,146	8,578
August	Catch	72,038	84,708	2,348	13,738	23,238	5,097	8,166	28,203	900	3,919	242,355
	S.E.	5,514	7,566	350	1,774	2,322	1,222	5,137	3,437	165	641	11,681
September	Catch	30,349	53,801	3,348	10,734	23,146	1,759	2,731	12,202	740	2,152	140,962
	S.E.	4,490	6,212	669	1,668	2,764	316	1,177	1,471	132	279	8,565
October	Catch	16,674	1,054	153	1,335	1,959	968	228	2,902	486	436	26,195
	S.E.	9,145	320	70	490	530	277	342	1,167	358	284	9,275
Nov+Dec	Catch	1,590	0	50	84	121	156	765	16,152	433	393	19,744
	S.E.	1,362	0	35	31	51	110	519	6,341	368	339	6,527
Total	Catch	191,552	226,857	9,811	42,760	90,122	10,895	18,280	93,472	7,916	12,889	704,554
	S.E.	12,825	11,495	909	3,149	5,116	1,380	5,481	8,354	1,101	1,506	20,946

APPENDIX B–9. STRAIT OF GEORGIA ROCKFISH CATCH SUMMARY, 1990.

Month		Statistical Area										
		13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Catch	170	0	1	602	187	483	42	1,081	22	129	2,717
	S.E.	154	0	1	372	75	236	31	396	18	143	634
March	Catch	0	24	3	431	224	127	246	1,474	19	8	2,556
	S.E.	0	10	2	368	62	67	282	492	14	5	682
April	Catch	567	152	81	265	334	541	60	3,216	121	39	5,376
	S.E.	228	49	56	112	89	244	41	1,816	51	12	1,855
May	Catch	1,419	1,465	225	6,256	2,510	724	801	1,407	341	836	15,984
	S.E.	344	397	75	944	647	188	571	396	96	331	1,493
June	Catch	1,064	1,417	115	6,540	5,247	1,003	735	2,135	1,403	1,641	21,300
	S.E.	206	359	31	1,176	855	245	682	412	365	489	1,831
July	Catch	5,144	7,085	1,173	9,641	2,428	1,845	2,355	5,057	3,185	2,556	40,469
	S.E.	1,081	1,274	276	1,557	443	383	774	982	634	646	2,832
August	Catch	5,131	7,283	431	9,450	2,740	1,293	2,813	2,799	542	1,476	33,958
	S.E.	735	1,055	82	1,228	401	278	2,035	458	98	255	2,799
September	Catch	3,272	4,091	435	9,808	1,860	1,397	1,138	2,191	496	1,022	25,710
	S.E.	516	1,098	102	1,718	259	355	734	374	118	197	2,315
October	Catch	1,962	1,369	13.	171	290	169	0	577	150	109	4,810
	S.E.	1,391	476	10	91	103	85	0	339	90	64	1,521
Nov+Dec	Catch	0	883	6	15	68	431	42	451	72	10	1,978
	S.E.	0	304	4	10	30	505	71	273	78	13	659
Total	Catch	18,729	23,769	2,483	43,179	15,888	8,013	8,232	20,388	6,351	7,826	154,858
	S.E.	2,036	2,133	321	3,075	1,266	910	2,481	2,351	765	946	5,818

APPENDIX B–10. STRAIT OF GEORGIA LINGCOD CATCH SUMMARY, 1990.

Month		Statistical Area 13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Catch	0	0	0	0	0	0	0	2	0	0	2 *
	S.E.	0	0	0	0	0	0	0	1	0	0	1
March	Catch	0	0	0	0	0	0	0	72	0	0	72 *
	S.E.	0	0	0	0	0	0	0	64	0	0	64
April	Catch	0	12	1	23	93	0	0	154	6	2	291 *
	S.E.	0	7	1	18	44	0	0	117	6	2	127
May	Catch	5,077	220	26	997	250	278	63	635	36	80	7,662
	S.E.	1,249	82	11	276	102	111	59	218	17	53	1,311
June	Catch	1,566	1,083	39	1,247	589	208	12	575	48	83	5,450
	S.E.	410	257	17	285	167	67	13	121	22	34	604
July	Catch	3,814	2,116	312	1,262	628	101	344	736	23	42	9,378
	S.E.	629	501	85	349	160	62	203	156	15	18	933
August	Catch	1,643	840	47	902	424	281	0	738	32	98	5,005
	S.E.	266	169	14	181	80	119	0	122	16	34	411
September	Catch	1,208	492	33	562	314	134	12	528	1	22	3,306
	S.E.	338	118	12	151	61	55	14	137	2	10	421
October	Catch	329	0	0	0	0	0	0	114	0	0	443
	S.E.	401	0	0	0	0	0	0	104	0	0	414
Nov+Dec	Catch	0	0	0	23	21	0	0	45	0	18	107 *
	S.E.	0	0	0	20	10	0	0	51	0	30	63
Total	Catch	13,637	4,763	458	5,016	2,319	1,002	431	3,599	146	345	31,716
	S.E.	1,571	605	89	579	276	195	212	389	36	80	1,870

* A total closure for lingcod was in effect from January 1 to April 30, and November 15 to December 31, 1989; see Table 3 footnote.

APPENDIX B–11. STRAIT OF GEORGIA DOGFISH CATCH SUMMARY, 1990.

Month		Statistical Area										
		13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Catch	0	0	0	18	0	0	0	0	3	5	26
	S.E.	0	0	0	24	0	0	0	0	6	8	26
March	Catch	0	4	0	4	119	0	0	0	30	6	163
	S.E.	0	6	1	6	122	0	0	0	44	11	130
April	Catch	0	10	0	0	0	0	0	0	0	0	10
	S.E.	0	10	0	0	0	0	0	0	0	0	10
May	Catch	0	7	3	0	11	16	0	9	38	71	155
	S.E.	0	8	3	0	9	11	0	10	17	51	57
June	Catch	0	54	1	2	27	0	0	0	28	54	166
	S.E.	0	22	1	3	32	0	0	0	26	57	74
July	Catch	99	70	29	8	43	0	0	73	152	110	584
	S.E.	55	33	15	10	25	0	0	62	51	47	117
August	Catch	0	113	4	141	1	0	0	142	71	222	694
	S.E.	0	92	4	108	1	0	0	41	28	87	174
September	Catch	0	235	6	138	93	104	37	30	0	7	650
	S.E.	0	86	5	54	61	68	32	40	0	5	146
October	Catch	0	49	0	0	0	67	0	12	0	0	128
	S.E.	0	56	0	0	0	65	0	17	0	0	87
Nov+Dec	Catch	0	0	0	103	0	0	0	0	0	0	103
	S.E.	0	0	0	113	0	0	0	0	0	0	113
Total	Catch	99	542	43	414	294	187	37	266	322	475	2,679
	S.E.	55	144	17	168	143	95	32	87	80	126	335

APPENDIX B–12. STRAIT OF GEORGIA CATCH SUMMARY FOR OTHER FINFISH, 1990.

Month		Statistical Area										
		13	14	15	16	17	18	19A	19B+	28	29	Total
Jan+Feb	Catch	52	0	1	154	45	72	150	1,337	5	41	1,857
	S.E.	57	0	0	116	30	109	112	643	6	47	677
March	Catch	0	39	0	18	38	63	107	710	62	12	1,049
	S.E.	0	31	1	24	27	36	126	292	69	17	331
April	Catch	26	67	25	93	179	19	0	2,500	39	14	2,962
	S.E.	17	20	15	41	48	13	0	1,205	24	7	1,207
May	Catch	74	184	26	482	66	179	879	878	21	48	2,837
	S.E.	41	87	11	182	31	83	821	276	10	32	895
June	Catch	118	537	39	253	486	50	48	742	137	151	2,561
	S.E.	51	223	19	74	219	25	52	181	65	85	392
July	Catch	790	809	271	274	994	279	252	1,913	974	827	7,383
	S.E.	151	230	80	103	517	101	155	339	269	292	817
August	Catch	1,050	727	68	882	527	233	140	2,098	144	365	6,234
	S.E.	202	183	17	201	179	112	163	487	66	156	672
September	Catch	826	656	67	549	179	79	0	131	64	94	2,645
	S.E.	198	190	19	166	45	44	0	51	25	33	334
October	Catch	567	3	0	0	56	0	0	307	81	58	1,072
	S.E.	458	4	0	0	30	0	0	260	65	44	533
Nov+Dec	Catch	0	0	2	0	0	20	0	72	605	717	1,416
	S.E.	0	0	1	0	0	34	0	98	1,072	1,073	1,520
Total	Catch	3,503	3,022	499	2,705	2,570	994	1,576	10,688	2,132	2,327	30,016
	S.E.	566	426	88	365	596	216	869	1,578	1,114	1,129	2,609

APPENDIX C

STRAIT OF GEORGIA CREEL SURVEY STUDY AREA

APPENDIX C. STRAIT OF GEORGIA CREEL SURVEY STUDY AREA.

The Strait of Georgia Creel Survey study area and landing site locations used in 1990 are shown in Figure C-1. The study area includes those waters of Juan de Fuca Strait and the Strait of Georgia bounded in the south by a line from Sheringham Pt. on Vancouver Island due south to an intersection with the International Boundary and along the International Boundary to the B.C. Mainland coast at Blaine (Boundary Bay) and in the north by the following 3 boundary lines:

1) in Discovery Passage from Granite Pt. on Quadra Island to the stream mouth west of Moriarty Pt. on Vancouver Island.

2) in Okisollo Channel from Granite Pt. on Quadra Island due north to Sonora Island.

3) in Cordero Channel from Burnt Bluff on the mainland 214° passing west of Dent Island to Sonora Island.

The area for which the Strait of Georgia Creel Survey statistics apply includes the above listed administrative area with the exception of the following areas:

1) Bute Inlet above a line from Lawrence Pt. running across the inlet. This area coincides with management units 13-21 and 13-22.

2) Waters of Pryce Channel, Waddington Channel, Pendrell Sound, Homfray Channel and Toba Inlet bounded by a line drawn from Horace Head on East Redonda Island at the south end of Waddington Channel to the northern point of Roscoe Bay on West Redonda Island and a line drawn within Homfray Channel from Price Pt. on the eastern shore of the channel by a line drawn from George Head at the easterly entrance of Ramsay Arm to Sutil Pt. on Cortes Island.

3) Hotham Sound above a line drawn from Elephant Point on the western shore of the Sound to the southern point of Granville Bay on the eastern shore of the Sound.

4) Jervis Inlet above a line drawn within Prince of Whales Reach from the mouth of Treat Creek on the east shore across the Reach to the summit (1625') at the head of Goliath Bay.

5) Sechelt Inlet including Narrows Inlet and Salmon Inlet above a line drawn within Skookumchuck Narrows from the "dog-leg" point southeast of the Egmont Pt. 224° across the Narrows to Sechelt Peninsula.

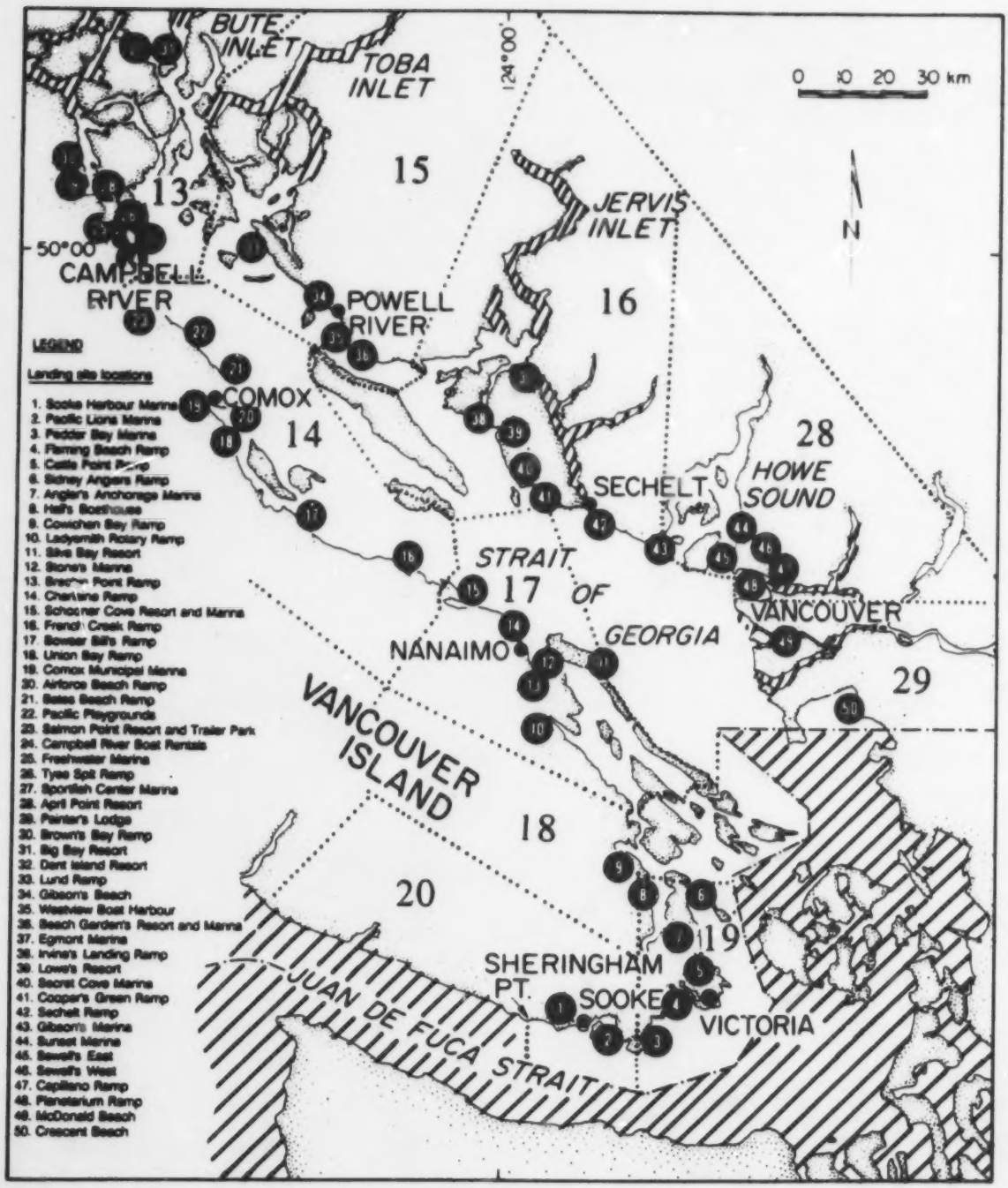

Figure C-1. Strait of Georgia Creel Survey study area and landing site locations; hatched areas are not included in the survey area.

APPENDIX D. SPECIES COMMONLY INCLUDED WITH OTHER FINFISH.

Pacific Herring
Pacific Cod
Pacific Tomcod
Walleye Pollock
Pacific Hake
Perches - any perch, seaperch or surfperch
Greenlings
Flounders - Pacific Halibut, any flounder or sole

APPENDIX E

PREVIOUS STRAIT OF GEORGIA CREEL SURVEY REPORTS

APPENDIX E. PREVIOUS STRAIT OF GEORGIA CREEL SURVEY REPORTS.

Shardlow, T. F., K. K. English, T. Hoyt, G. E. Gillespie and T. A. Calvin. 1989. Strait of Georgia Creel Survey sport fishery statistics, 1983. Can. Manuscr. Rep. Fish. Aquat. Sci. 1872 : 53 p.

Shardlow, T. F. and L.D. Collicutt. 1989 a. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1984. Can. Manuscr. Rep. Fish. Aquat. Sci. 2032 : 61 p.

Shardlow, T. F. and L.D. Collicutt. 1989 b. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1985. Can. Manuscr. Rep. Fish. Aquat. Sci. 2033 : 60 p.

Shardlow, T. F. and L.D. Collicutt. 1989 c. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1986. Can. Manuscr. Rep. Fish. Aquat. Sci. 2034 : 61 p.

Shardlow, T. F. and L.D. Collicutt. 1989 d. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1987. Can. Manuscr. Rep. Fish. Aquat. Sci. 2035 : 62 p.

Shardlow, T. F. and L.D. Collicutt. 1989 e. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1988. Can. Manuscr. Rep. Fish. Aquat. Sci. 2036 : 63 p.

Collicutt, L.D. and T.F. Shardlow. 1990. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1989. Can. Manuscr. Rep. Fish. Aquatic Sci. 2087 : 75 p.